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# Dairy and Food Sanitation

*A Publication of the International Association of Milk, Food and Environmental Sanitarians, Inc.*

Refrigerated Packaged  
Orange Juice Can Be  
Monitored For Freshness

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Cryptosporidiosis -  
A "New" Cause Of  
Gastroenteritis

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Computer-Aided  
Cheese Tasting  
Underway at  
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# **Refrigerated Packaged Orange Juice Can Be Monitored For Freshness Using Polymer Indicator Label**

by J. H. Chen and R. R. Zall  
Department of Food Science  
Cornell University  
Ithaca, NY 14853

## **Introduction**

While orange juice has been marketed for over half a century, it only recently increased its volume adequately enough to be quantified with beverage sales. Commercial refrigerated orange juice should be distinguished from frozen concentrates or liquid juice packaged in cans or glass bottles which do not need refrigeration. Today's refrigerated orange juice is packaged in poly board and plastic containers and has gained considerable popularity. The success of "dairy case" packaged liquid orange juice results because its flavor closely approximates fresh squeezed juice.

It is well known that processed juice flavor is difficult to maintain. Orange juice can develop disagreeable odors and off-flavors rapidly when the juice is not refrigerated. Product deterioration results from spontaneous chemical changes in juice that occur as the product is held in storage (1) and accelerates with warmer temperature.

The distribution of orange juice from processors to consumers is a wide-spread market that provides ample opportunities for product temperature abuse. Mishandling of product often interferes with expiration dates marked on containers and as such circumvents a loose guarantee of merchandise quality. To reduce quality problems, it would be useful to have a tool which predicts changes in product quality that is sensitive enough to monitor the freshness of packaged goods in the marketplace. To this end, Allied Corporation of Morristown, New Jersey developed its Lifelines Inventory Management System, a computerized time-temperature monitoring scheme, and targeted it for use with perishable foods during storage and distribution. This paper reports the results of labora-

tory studies designed to test the feasibility of the Lifelines System when it was applied to commercially packaged orange juice destined for refrigerated storage.

## **The Objectives Of This Study Were:**

1. To determine changes in quality or shelf life of packaged orange juice stored at refrigerated and non-refrigerated temperatures as measured by select organoleptic, biological and chemical parameters.
2. To evaluate the feasibility of using Lifelines Inventory System for measuring freshness and shelf-life characteristics of orange juice when the commodity is challenged by different time/temperature conditions.

## **Methods**

Samples of commercially processed orange juice packaged in poly board containers were obtained from a commercial juice processor who shipped its fresh material to Cornell University using an over-the-road refrigerated vehicle. The packaged orange juice was filled with product from two different lots manufactured separately on February 26 and 29 of the test year with expiration dates stamped on individual cartons of April 8 and 11. The juice arrived in Ithaca in a single shipment on March 16 and was immediately stored at 2, 4, 10 and 21°C for study. At pre-scheduled intervals, samples were removed from storage and subjected to microbial, chemical and organoleptic analysis. For organoleptic study, a nine point hedonic scale was used to grade samples of juice which were tempered at 10°C for 2 hours prior to each evaluation. The taste panel was made up of 7 to 8 people from the Department of Food Science. Microbial tests included

molds and yeasts determinations that were carried out according to procedures outlined in standard methods for the examination of dairy products (2). Chem4,1 analysis focused on using the Furfural test but the sensitivity was inadequate and chemical testing was discontinued. Procedure used for the Furfural test followed colorimetric methods of Dinsmore, H. C. and Nagy, S. (3).

Color changing polymer indicators were used with a bar code system as part of the Lifelines Inventory System and provided by Allied Corporation of Morristown, New Jersey. The system has been previously described by Zall and coworkers (4) where the combined effect of time and temperature irreversibly affect a light-colored polymer. A decrease in polymer reflectance is used to quantify product freshness. Polymer labels were stored/incubated similar to samples of orange juice samples at 2, 4, 10 and 21°C and these were periodically viewed using an optical wand. Reflectance results were recorded and stored in a hand-held microcomputer (part of the Allied System).

### Results and Discussion

Juice organoleptic evaluation data are summarized in Table 1. The numbers represent the perceived degree of sample freshness at time of evaluation.

When orange juice is packaged in poly-board containers, it requires refrigeration to retain quality characteristics throughout anticipated shelf life of about 6 weeks. This is the time period recommended by an orange juice processor in which to offer product for sale. Taste characteristics for orange juices stored at 2 and 4°C remained pretty much unchanged over the test periods, while the scores for juice stored at 10 and 21°C decreased over time. Samples of orange juices stored at 2°C. When stored at 21°C, the orange juice lost flavor and scored 3.25 within 7 days of storage. At higher temperature, juice degradation was accelerated. Criticisms were discoloration, lack of freshness, bitterness and foreign taste. These characteristics were the key changes in samples of orange juices when stored over time at elevated temperatures. The panel valued juice with the aforementioned defects less than control juices and rated the samples with low scores. A decrease in score was given for samples of juice held at 10 and 21°C long before growth of the molds and yeasts was detected. Mold and yeast count data are listed in Table 2. No mold or yeast growth was detected in samples of juice held 14 days at 10°C even though samples of orange juice scored significantly lower than control product held at 2°C. Orange juice degradation did not seem to be initiated by the microbial growth which was further supported by the observation that samples of orange juice degraded within 7 days when held at 21°C without increase in numbers of mold and yeast. However, additional incubation time did lead to increased numbers of molds and yeasts.

Change in juice quality during the storage was probably initiated by chemical change where the rate of the change was time/temperature dependent. The different trials with polymer indicators show that the system can

be used to track the cumulative effects of time/temperature exposures.

Polymer indicators of specified sensitivity can be provided by Allied Corporation to fit specific product degradation curves. These polymers will be able to detect changes in product quality through different time/temperatures where changes in color are irreversible. Change in colors acts as an indicator which can then be read as changes in reflectance. Although the level of reflectance can be viewed by "eye balling", color intensity as polymer reflectance was read using an optical wand. Multiple readings were taken of each test label and the results averaged. Figure 1 shows plots of polymer indicator reflectance over exposure time. The changes in reflectance was a function of the combined effects of time and temperature.

Organoleptic data of how product tastes when held at different storage conditions were compared with polymer indicator reflectance data. The correlation between panel taste scores and reflectance for samples stored at 2°C was  $r = -0.272$  and  $r = -0.448$  at 4°C and as such was not significant. It's probably that because orange juice is by nature acidic that the acidity masks slight flavor changes. In addition, the polymer used in the test were less sensitive to change at cold temperature over time. When the temperature of incubation/storage was raised to 10°C and above, the correlation between the taste score of the orange juice and the reflectance of the polymer indicator became higher and the data were significant at 95% confidence level. Correlation values were  $r = 0.894$  and  $0.915$  respectively for samples incubated at 10°C and 21°C. Statistically significant value of correlation data between taste scores and the indicator reflectance values occurred only when the product was stored at temperatures higher than more common refrigeration levels of 2-4°C. The information collected from the different trials shows that polymer indicators can be used to measure orange juice freshness should the product be temperature abused.

Figure 2 shows plots of juice taste scores versus polymer reflectance. For those samples stored at 2°C and 4°C, the score remained unchanged possibly because the rates of change were too small to be detected by organoleptic method. Flavor scores for samples stored/incubated at 10°C and 21°C show a slow decline which was then followed by a rapid change beginning at some discernable turning point. Two regression equations were prepared from the data of the 10 and 21°C trials and they are drawn in Figure 2 with an intercept taste score of 4.91 and reflectance of 38.70. The two regression lines depict the sudden change in juice quality at the time/temperature conditions. A reflectance of 38.7 was about midway of the initial reflectance ability of the polymer used in the trials. When orange juice samples scored 5 and under, the data were statistically significant at a 95% confidence level as being taste different from control samples. The study shows that the Lifelines System can be used to predict orange juice freshness and ought to be valuable as a monitoring tool.

TABLE 1. Taste scores in samples of commercially packaged orange juice stored over time at different temperatures.

Temp. °C	Taste Scores <sup>1</sup>							Correlation <sup>2</sup> (r)
	(Days of Storage)							
	0	3	7	10	14	21	24	
2	6.20	6.67	6.00	7.00	6.00	6.78	6.60	-0.272
4	6.20	6.00	5.50	7.00	—	6.44	6.60	-0.448
10	6.20	5.67	6.25	5.00*	5.00	4.78*	4.20*	0.894
21	6.20	5.33	3.25*	0.67*	0.00*	—	—	0.915**

\* Score significant at 95% level different from samples stored at 2°C.

\*\*Significant at 95% confidence level.

<sup>1</sup>9 = very goo; 7 = good; 5 = medium; 3 = poor; 1 = very poor; 0 = unacceptable (spoiled).

<sup>2</sup>Correlation between the taste score and the reflectance of polymer indicator.

TABLE 2. Mold and yeast counts in samples of commercial orange juice<sup>1</sup> stored over time at different temperatures.

Temp. °C	Days					26 <sup>2</sup>
	0	7	14	21	26	
2	<10 <sup>1</sup>	<10 <sup>1</sup>	<10 <sup>1</sup>	<10 <sup>1</sup>	<10 <sup>1</sup>	<10 <sup>1</sup>
10	<10 <sup>1</sup>	<10 <sup>1</sup>	<10 <sup>1</sup>	—	—	2.1 × 10 <sup>5</sup>
21	<10 <sup>1</sup>	5 × 10 <sup>1</sup>	4.2 × 10 <sup>4</sup>	9.0 × 10 <sup>5</sup>	—	—

<sup>1</sup>Molds were not detected.

<sup>2</sup>Incubation terminated on orange juice expiration date.

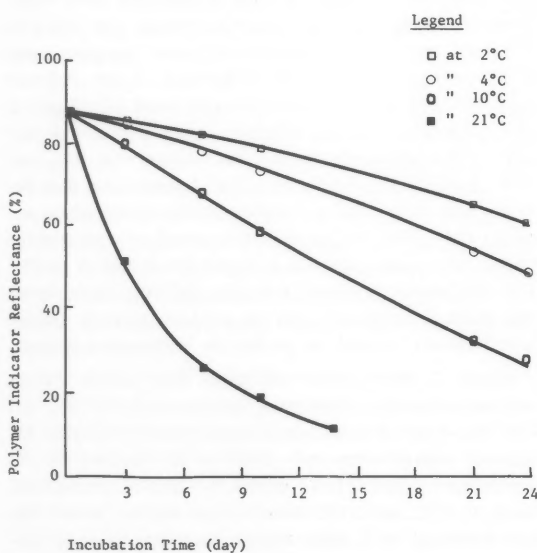


Figure 1. Reflectance plots of polymer indicator incubated at different temperatures over time.

### Acknowledgements

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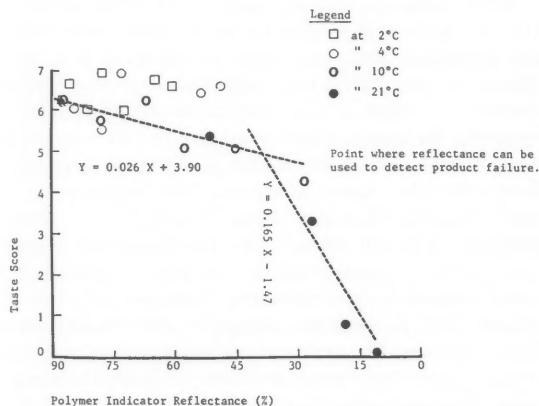


Figure 2. Taste score plots of orange juice vs. polymer indicator reflectance when incubated at different temperatures over time.

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## **Better Today Than Yesterday? - But What About Tomorrow?**

**Joseph C. Olson, Jr.**  
Sun City Center, Florida 33570

This paper was presented as the keynote address at the 73rd IAMFES Annual Meeting, August 3-7, 1986 at the Radisson South, Minneapolis, Minnesota.

I am privileged indeed to be the first recipient of your annual meeting lectureship established in honor of Ivan Parkin. I am especially pleased, too, that you have so honored Ivan. I remember well the sound, compelling and valiant service he has given to this Association over many years, and particularly during the late 1940's and 50's. Those were dynamic years as our Association struggled to place itself in a position of leadership. A struggle that was eminently successful. I salute you, Ivan, as well as your colleagues of those early years. I am grateful, too, for the opportunity to attend this meeting. My work during the past decade or so has left little time to continue the close association I had previously in our Association's affairs. Nevertheless, I have remained quite aware of your efforts.

I am not quite certain just how the title of my paper evolved. It implies, of course, that it might include something of the past, present and future. In any event, it gave me considerable latitude in its preparation. I admit taking full advantage of the opportunity.

I would like to begin with a few remarks about this Association which, I hope, will celebrate in 1988 its diamond anniversary of its founding. Also, next year will mark the 50th year of publication of its journal, currently bearing the title, *Journal of Food Protection*. Our Association possesses a rich heritage born of many accomplishments. I would like to speak of only three, which in my view, are outstanding.

First is the continuous role of the Association in the formulation of 3-A Sanitary Standards and Accepted Practices. This Association has been an integral part of the 3-A Sanitary Standards Program since its beginning 52 years ago in 1934. It began in recognition of the first axiom relative to cleaning food handling equipment; namely, that it must be cleanable. That requires sanitary design. The program is a classical example of what can

be attained in our field of interest through integration of efforts of sanitarians, regulatory agencies and industry, each having a major stake in its objectives. The fruits of the program are evident in the design, function and operation of most milk production and processing equipment, and increasingly so, in equipment used by other food industries. I am convinced that the sanitary design of equipment has, directly and indirectly, contributed more than any other factor to the safety and quality of dairy products. Likewise, the "spill-over", so to speak, of this program, is increasingly having a similar consequence in respect to other foods. In light of emerging technologies, I see an accelerating need for the 3-A Sanitary Standards Program in the future.

The second activity I wish to mention is that of the Committee on Applied Laboratory Methods. I feel its work may not have been fully recognized or appreciated. The impetus of this Committee flowered under the leadership of its Chairman of many years, Dr. Luther Black. The methodology organized and otherwise stimulated by this Committee is the basis for much of the content of successive editions of "Standard Methods for the Examination of Dairy Products", now in its 18th edition. Furthermore, its work led, indirectly, to recognition of the need for greater continuity of effort in the intervals between editions. Fulfilling this need required financial resources beyond that inherent in the labor of contributing authors and the resources of their employers. Fortunately, in 1968 when preparation of the 13th edition of "Standard Methods" began, the Food and Drug Administration provided the necessary funding. To their credit they have continued to do so through successive editions. Also, the work of the Committee, undoubtedly, played a role in stimulating the preparation of the "Compendium of Methods for the Microbiological Examination of Foods", now in its second edition. Funding for preparation of this book also was provided by FDA.

The last activity of our Association I will mention is its sponsorship of the *Journal of Food Protection*. This

Journal emerged in 1937 as the Journal of Milk Technology. Then, as the scope of interest and concern of the Association broadened, so did that of the Journal. This is reflected in the name changes, first, to the Journal of Milk and Food Technology and, currently, the Journal of Food Protection. During the 19-year leadership of its current editor, Dr. Elmer Marth, the scientific content of the Journal has more than doubled that of previous years. And, more importantly, its stature among other scientific journals is highly respected. An author of scientific paper generally has two primary desires in respect to publication of his work. First, is that it reach the people he feels should see it; and, second, that it be published in a journal of high credibility. Our Journal fulfills these two criteria in admirable fashion.

In concluding this brief account of just these three activities of the Association, the point I wish to leave with you is that it serve to bolster your conviction that your Association's activities are indeed noteworthy and that it will stimulate greater individual participation, as well as to encourage you to enthusiastically seek others, particularly those just beginning their careers, to join in fulfilling our Association's objectives. Better today than yesterday? - Oh yes, and tomorrow? - the future looks promising indeed.

I would like now to turn to other matters. We certainly are in the midst of an exciting sequence of events relative to food safety and quality. Almost daily we see practical and beneficial applications of new knowledge being put into place. This is occurring largely through the ever-increasing reservoir of knowledge gained through research and through imaginative thought that new knowledge inspires.

On the other hand, there are disturbing elements relative to health hazards associated with foods. We must be more fully cognizant of these, lest through negligence of their significance, we compromise the safety and quality of foods reaching the public.

Let me attempt to place a few of these troublesome situations in perspective. In doing so I must be selective. I am sure that all of us are concerned with all of the six classes of health hazards of foods. These being microbiological hazards, malnutrition, environmental chemical hazards, natural poisons or toxic substances, pesticide residues and food additives. It may surprise some that in terms of human morbidity alone, the importance of microbiological hazards in foods in this country exceeds that of the remaining classes of hazards just mentioned. My competence is largely restricted to microbiological hazards to which my comments will be directed.

First, let us look to the incidence of foodborne illness in this country, which is largely diarrheal disease often with other associated symptoms. At last we are beginning to get a pretty good handle on this. What is revealed is shocking. Five years ago, Hauschild, from Health and Welfare, Canada, and Bryan, then at CDC estimated food-and-waterborne illness at 1.4-3.4 million cases annually (J. Food Prot. 43:435-440, 1980). Their estimate

was based on data from follow-up surveys after various outbreaks. They considered the ratio of estimated cases versus initially reported cases to be 25:1. Later Todd, also from Canada, estimated the cases in the United States at 5 million per year (Proc. 2nd Nat'l. Conf. for Food Protection, 1984). Some, including myself, believe both estimates were gross underestimations. There is a statement in Frazier's textbook "Food Microbiology" to the effect that it seems logical to believe that each of us among our population experiences at least four bouts of foodborne illness over the course of a lifetime. Considering our population at 250 million, that's four billion cases. Assuming life expectancy at 70 years it translates to 14.2 million cases annually. I have often used that accounting in answer to questions about incidence - but not anymore. Last year Archer and Kvenberg, from FDA's Division of Microbiology, introduced a new dimension into the estimation of the incidence of foodborne illness (J. Food Prot. 48:887-894, 1985). Briefly, this is their reasoning. They made the very logical assumption that, "if a person acquires diarrheal disease through food consumption and subsequently spreads the disease through person-to-person contact, logically then all involved persons in the outbreak could be scored as illness due to a food source". They went on to present a logical basis for 4,455,000 cases annually due to salmonella, campylobacter and shigella combined. They doubled that value to account for all other known pathogens transmitted by foods. That brings the number to 8,910,000. They doubled it again to approximately 18 million cases since evidence indicates that a causative agent is found in only about one-half of all medically investigated cases, yet, evidence indicates the presence of some enteric pathogen. Approximately one-third additional cases may be added owing to person-to-person transfer subsequent to primary acquisition of foodborne illness - the new dimension. That brings the number to 24 million cases per year. But that is probably not all, since, for example, in several large outbreaks of salmonellosis, the ratio of cases to number of human isolations was 100:1 rather than 29.5:1 used in arriving at the 24,000,000 number. Thus the estimate may be as high as 81 million cases annually.

Then there is the matter of costs - this is difficult - but we can put the financial drain in some perspective. We got some help recently from Todd in Canada (J. Food Prot. 48:169-180; 48:621-633, 1985). Briefly, for 17 outbreaks due to mishandling in food service establishments, he found the cost per outbreak ranged from 17,000 dollars to a little over one million dollars. The average per case was \$788 for outbreaks due to mishandling by food processors; the average cost was about \$34,000 per case. At our estimated incidence of 24-81 million cases, our annual cost probably ranges at least from 19-64 billion dollars annually. Now, as John Siliker would say, we microbiologists are accustomed to dealing in orders of magnitude. So don't be disturbed by differences in numbers. The bottom line is that foodborne illness in this country is a major public health problem.

More so, unfortunately, than many realize. In light of the incidence in our country where we have probably the safest food supply in the world, possibly closely approached by Japan and Sweden, what must the problem be in terms of morbidity and mortality in certain other areas of the world that come to mind? It boggles the mind.

Now let us take a look at what is doing all this damage. Not long ago Frank Bryan sat down and read all the literature on the subject and came up with an exhaustive list of about 55 organisms that, at one or more times, had caused a reported foodborne outbreak in this big wide world of ours. However, there is good reason to believe that only one-third of those 55 are transmitted by foods with consequences and/or frequencies serious enough to be of concern in this country. I would like to show you a slide now, taken from the NAS/NRC report, released about one year ago, on the "Role of Microbiological Criteria for Foods and Food Ingredients". There you see the list of about 20 organisms thought to be of concern at that time - only about one year ago. There is a notable omission - *Listeria monocytogenes*. None of us on the Committee that prepared that report had the foggiest idea of the magnitude of its importance that we recognize today. Most of you realize now that it is an extremely dangerous pathogen. Of course it should be listed in the severe category.

How quickly we can be brought up short by some unforeseen happening. In this connection, I recall a statement made by General Bayne Jones some years ago. He is a former Surgeon General of the Army and the author of a textbook on medical microbiology that was the state of the art for many years.

He was giving an address on infectious disease problems of the military. When he came to malaria, he described the great strides made in malaria control - the effect of DDT, control of mosquito breeding areas, chemotherapy, etc. And then he concluded with the remarkable statement that there was little left to do but write the history of malaria! How wrong he was. Malaria came back and its victims at any given time still are counted in the millions.

In our profession, too, we cannot afford to become complacent. As one of my former mentors, Dr. H. O. Halvorson, often pointed out "Anything will happen that can happen."

So now we have *Listeria* with us. More has been spoken and written about *Listeria* in the last 18 months than about any other foodborne organism over a similar period in my memory. No less than eight papers about it, including this epidemiology, will be presented at this meeting. Nevertheless, I would like to make a few brief comments about *Listeria* that perhaps need emphasis. No doubt its threat, particularly to the dairy industry, is very serious.

Its prevalence in raw milk supplies, its apparent heat resistance and psychotropic nature, and its persistence of hardiness are the particular characteristics that challenge

our ability to control this organism. The heat necessary to kill *Listeria* in raw milk appears to be close, perhaps slightly above, the minimum exposure required for pasteurization. This is disturbing - but we have faced the problem of heat resistance of other organisms before and solved it - for example, *Mycobacterium tuberculosis* whose heat resistance was for years the basis for the minimum milk pasteurization temperature-time requirements. Then in the late 1940's and early 1950's, *Coxiella burnetii* the Q fever organism, came into the picture. Its heat resistance made it necessary to increase the severity of the pasteurization process to the present levels required. I am optimistic about the effectiveness of pasteurization in killing *Listeria*. If necessary, heat treatments can be raised somewhat above present minimums. In fact, heat treatments used in many plants are considerably more severe than minimums presently required for pasteurization - and for good reasons. On the other hand, the cheese industry may have to step up its pursuit of technologies to allow production of good cheese from milk given heat treatments considerably higher than that of present practice. That technology already has come a long way. But, it is the psychotropic nature and hardiness or persistence of *Listeria* which, to me, is most troublesome, in fact, down right threatening. Its ubiquitousness in raw milk supplies and in-plant environments is now quite evident. That means great potential for post-pasteurization contamination. Add now the hardiness of the organism and its ability to grow relatively rapidly at 45-55°F. One can immediately then appreciate the problem facing, particularly, the fresh and ripened soft cheese industry. In the latter case, Camembert or Brie for example, 10 days at 50-54°F is inherent in the ripening process. That provides selective culture temperature conditions for *Listeria*. Prevention of post-pasteurization contamination of product to an extent far greater than present practices allow will be needed. I am not optimistic about accomplishing that. However, increasing advances in automation and use of ultrafiltration of milk in the cheese-making process should contribute to the feasibility of designing closed systems where product contact surfaces can be virtually sterilized and protected from contamination before use. Two excellent references provide stimulating reading on this subject: first, Frank Kosikowski's review in the June, 1986 issue of Food Technology on cheese-making procedures utilizing ultrafiltration of milk; and second, Dale Seiberling's discussion in the August, 1985 issue of Dairy Field on automated dairies. Also, he will speak on a related topic at this meeting Tuesday afternoon - don't miss it.

I would like now to turn to a problem that has plagued us for far too long. I refer to the persistent and quite likely increased consumption of raw milk. In outbreaks of *Listeriosis* so far, the most frequent vehicle of transmission was raw milk or a milk product in which raw milk was used in its preparation. Furthermore, raw milk outbreaks of salmonellosis and hemorrhagic colitis and others continue to occur with regularity. The situation is

ridiculous. Especially so in view of the fact that the sale of raw milk is still legal in 20 states, yet, the scientific evidence against raw milk is irrefutable. Nevertheless, the raw milk industry and its cult of advocates cannot be taken lightly. The legal aspects involved in preventing the sale of raw milk are complex; especially these days in a climate of concern for personal liberties, freedom of choice and frequent rejection of scientific truth. Fortunately, the segment of the dairy industry that engages in the sale of raw milk is small. But, nevertheless, it deliberately or through ignorance of consequences, continues to provide a hazardous product to consumers. Some of what I have just said, and more, about this disgraceful raw milk situation is more elegantly stated in an editorial by James Chin of the California Department of Health Services. It is included as an Appendix to the NAS/NRC report I referred to previously. Chin concluded with the statement, "It is the responsibility of all health professionals to see that the public - and the policy makers - are adequately informed about the scientific findings so that public policy on raw milk may be compatible with scientific knowledge and protective of public health.

It is time now again to ask a couple of questions. Is the situation relative to microbiological health hazards in foods better today than yesterday? It all depends on the period with which we compare today. The answer is sort of like that of the fellow who when asked by his friend, "How is your wife?", replied, "Compared to whom?" If we compare today with the first 20-25 year period of this century, the answer has to be a resounding, yes. Just the infant mortality statistics over the years supports that answer. If the comparison is over the last 20-30 years, I see little evidence of quantitative change in morbidity and mortality - in spite of the research, the surveillance of our health agencies, the quality control efforts of industry, the education work of our universities and other institutions, and our participation at the international level. I find that hard to take. Also, I doubt that we have had much qualitative change. The remarkable decrease in milkborne brucellosis, tuberculosis, typhoid fever and trichinosis from pork and others largely occurred by 1940 when pasteurization of milk became an almost universal practice. Our recognition of *Clostridium perfringens* in the '50's, *Vibrio parahaemolyticus* in the early '70's and in more recent years, pathogenic *E. coli*, *Yersinia Campylobacter* and *Listeria* is significant, of course, but their presence all along probably was merely obscured by an inability to detect them adequately.

Well, then, what has all this good work we've been doing for the last 25-30 years amounted to? Frankly, it has kept the situation from getting worse. That, in my view, is a noteworthy achievement. With our present level and direction of effort, we have been at the point of irreducible minimum for some time.

What about tomorrow? Can we do better? I believe so, but it will take some new direction of effort, dedication and hard work. And speaking of hard work, I am reminded of the experience of four of my contemporary

old prostates who, like myself, regularly engage in the game of golf. On a particularly hot afternoon John arrived home and flopped into his easy chair in utter exhaustion. His wife, noting his condition, alarmingly exclaimed, "Goodness, John, what in the world happened?, I've never seen you in this condition before." "Well, my dear," he said, "we were at the 7th green, Harry had just sunk a long putt, had a heart attack and died - and from then on it was - hit the ball and drag Harry - hit the ball and drag Harry!"

Well, back to the hard work. There was a time when information for public distribution on *prevention* of foodborne illness was issued regularly by the Public Health Service - pamphlets, leaflets, news releases, etc. Also slide series and motion pictures were made available for viewing at various meetings, including consumer groups. Also extension departments of many of our land grant universities and consumer affairs personnel of health agencies prepared similar materials and carried the message to the public. Over the last 15-20 years of my 51-year professional career to date, I have seen a steady eroding of that kind of preventive effort directed to the public and to a lesser extent, the food service industry. Labor turnover in food service establishments, large and small, is high. Every day new mothers and others begin taking on the task of food preparation in the home. Any good quality control manager knows the value of adequate initial training of new personnel and the need for continuity of that effort. Repetition of the message is all important. As a young boy, I was fascinated with a poster located in one of the spaces above the windows in every streetcar or electric trolley in Minneapolis and St. Paul. It contained the simple statement of a noted advertising executive, "Barron Collier says, Continuous contact with one's market plus constant repetition of one's message makes advertising pay". Change a word or two and you have the first axiom of a successful program of food protection. In a lighter vein, yet to the point, is the TV commercial in which former Green Bay Packer Paul Horning appears. Horning, you may recall, was one of Coach Lombardy's favorites, although his extracurricular activities frequently caused him considerable anguish. Horning is shown striding forth in sartorial splendor with a striking blond on his arm. Someone asks, "Paul, how do you do it?" and Horning replies, with a slight smile, "Practice, practice, practice!"

On the other hand, efforts directed toward the food processing industry is quite in contrast. Witness, for example, the frequent short courses, conferences, trade associations and various institute programs, and the pages of trade and scientific journals that keep the food industry oriented in current developments in food safety and quality. The results speak for themselves for the responsibility for only a small percentage of foodborne outbreaks can be laid at the door of the food processing industry. Rather, 90-95% are due to the mishandling of food in the home, day care centers, hospitals, schools and other institutions. Foodborne illness is generally preventable.

Isn't it obvious where the major preventive effort should be directed? The problem isn't the food arriving at the doors of these places - it's the abuse of foods and the cross contamination that occurs there that needs correction.

It seems to me that if we are to reduce the incidence of foodborne illness significantly in this country, our regulatory agencies, particularly the Food and Drug Administration, would do well to examine the order of their priorities in respect to use of their resources allotted for food protection. To continue to devote a major share of resources to programs geared to the food processing industry seems questionable. That area is where only 5-10% of the problem lies. When FDA acquired the Public Health Service milk and food operating programs in the re-organization of 1969-70, they inherited the legislative authority of Public Law 410, the Public Health Service Act. This act provides for basic initiatives toward food protection such as cooperation with states in research and investigations, training of state and local personnel, control of communicable diseases, the authority for promulgating regulations. Certainly, FDA has no lack of legislative authority to pursue these preventive initiatives. If we expect to get measurable improvement in the incidence of foodborne illness, *first*, strong Federal-state programs are needed with a much larger share of available re-

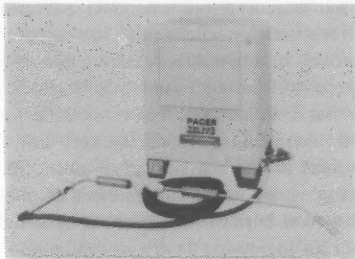
sources directed to the public and to the institutional segment of the food service industry; *second*, that part of the food service industry representing fast-food chains and large restaurants, as well as the food processing industry, will need to maintain their generally excellent level of food protection effort. *Third*, continue research on a variety of fronts, including detection, identity, enumeration, and the growth and survival characteristics of causative agents of foodborne illness about which such knowledge is lacking. *Fourth*, we need to apply promptly new knowledge that is applicable to preventive measures.

And, *finally*, let us not forget that education and training cannot do the whole job. Rigorous enforcement of legislative and regulatory requirements must be pursued.

And then, just maybe, those of the next generation will get by with an average of only one or two bouts of foodborne illness in their lifetime. How rigorously we devote our efforts to these objectives will largely determine whether or not we will continue to tolerate the 24-81 million annual cases of foodborne illness.

And that is about it, my friends. This Association has a vital role in improving and maintaining the integrity of our food supply and our environment. I wish you unbounded success and I thank you for your gracious reception. I look forward to a better tomorrow!

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## Worrying About the Right Issues In Food Safety

by Chris W. Lecos  
FDA Consumer Writer

Reprinted from the November 1986/FDA Consumer

Americans worry too much about the chemicals used in their food when they should be more concerned - from a health standpoint - about the growing problem of disease-causing microbes in the food supply, according to FDA's top food safety official.

Describing the public's fear of chemical additives in foods as "chemo-phobia," Sanford A. Miller, director of FDA's Center for Food Safety and Applied Nutrition, said that a recent agency study of the most widely used and best-tested food additives showed that the allowed levels for most of them had safety margins far greater than the minimum necessary to protect the public. Yet, he added, convincing the public of that is extremely difficult.

In this interview with FDA Consumer writer Chris W. Lecos, Miller discussed why he feels FDA no longer needs to invest so much of its limited resources on surveillance of chemical additives and why it needs to give a higher priority to microbiological hazards and food-borne disease.

**Q.** Why do you think microbiological contamination of food is more of a public health problem than chemical additives?

A. Over the last 30 years we have put an incredible amount of our resources into evaluating the safety of chemicals and in determining exposure levels of chemical contaminants in food. We've invested a great deal of effort to remove from food these chemicals which were potentially, if not actually, toxic. In that process, we have been extraordinarily conservative and cautious. The end result, I think, is that we would be hard put to point to substances in food today that would represent acute or chronic hazards. That's not to say there aren't small amounts of toxic substances in food, but in these cases,

their presence is in such small amounts as to be insignificant. There are those who believe we should carry this process on and ultimately get rid of everything, but there is really no health reason to do so.

During the same period, our concern for microbiological contamination of food remained at a relatively low level. Why? Because the early history of FDA was devoted to developing sanitary procedures in food processing plants that would preclude the possibility of these things, and we assumed we had pretty good control of this. With time, particularly as resources became more restricted, we increased our chemical surveillance, increased our research on chemicals, increased our action on the approval of chemicals - and a lot of those resources came out of the microbiological hazards program.

But what has become apparent is that the hazards associated with chemicals in foods are very low - in large measure because of the actions we've taken. What we're now observing is an increasing number of illnesses associated with food-borne disease, some of which are associated with an increasing laxity in sanitation. The conclusion we came to is that we have to pay a great deal more attention to microbiological hazards. That doesn't mean we don't do any chemical hazard work. It simply means we can maintain the status quo quite well with fewer resources devoted to it.

**Q.** How do you know the margin of safety with food additives is so great?

A. FDA, over the course of its history, has reviewed large numbers of compounds. We now have a fair amount of data on their potency. In addition, our ability to estimate actual exposure to these chemicals has become more sophisticated. More recently, FDA reviewed these data, and we were able to plot the current safety

margins of approximately 160 of the most heavily used and best-tested food chemicals. We discovered that the safety margin for more than 90 percent of these was a thousandfold or more, and, on the average, was ten thousandfold. So come on now! This is a tremendous margin of safety, particularly when you consider that current exposure for humans is very low and the toxicity of these things is not generally high.

*Q. Yet most surveys, including those conducted by FDA, seem to suggest that it's additives, preservatives and pesticides that worry the majority of consumers.*

A. Sure, but that doesn't really make them the problem. It means that people *perceive* them as the problem. There is in this country something that can only be called a "chemo-phobia." People are simply afraid of anything with the title chemical bestowed on it. I'm not going to repeat the old cliché that "everything is chemicals, all life is chemicals," but somehow or another, people believe that if it is produced by a plant, it's not a chemical; if it's produced by a chemist, it is a chemical. And that, of course is ludicrous.

Most people don't realize how safe the food supply is from a chemical point of view. They don't realize that virtually every person who has studied the food supply in recent years has come to the conclusion that, with cancer, for example, chemicals in food play only a minor role in the risk of cancer, although I am sure most people believe that food chemicals play a major role. It just isn't true.

*Q. You're saying, then, that even the public's concern about the cancer-causing ability of certain chemicals is exaggerated?*

A. A few years ago the National Academy of Sciences formed a committee of the most distinguished cancer epidemiologists in the world. This very distinguished group concluded that food-borne chemicals played a *trivial* role in cancer. In fact, it ranged from minus 5 percent of the risk to 1 percent of the risk. Why minus 5 percent? Because some of these chemicals are anti-carcinogens - they *reduce* the hazard of cancer. So all of these people who really know, and who are not so bound by ideology, are saying that the issues are not here, they are somewhere else.

*Q. What steps are we taking as an agency to give microbiological issues a higher priority?*

A. We're redirecting our microbiological work. We're pointing toward newer areas of microbiology that will help us understand better not only how to identify these organisms but also how they work, how they interact with food, and how you can make certain they won't exert their pathogenic action. I would say that FDA has become a world leader in such public health microbiology.

*Q. How is this redirection going to affect the food industry - and ultimately the consumer?*

A. We are developing guidelines and regulations for the industry - particularly the dairy industry - that take into account some of the new knowledge we've disco-

vered. We are developing programs to share this information and concern that we have. Finally, we are increasing our surveillance and inspection activities in microbiological areas, we are increasing our activities in the milk sanitation area, and we are doing more surveys to determine the dimensions of the problem.

We have learned over the last 10 years that none of these issues operates independently of the others. We can't separate the microbiological issues from the toxicological issues, from the nutritional issues, from the chemical issues. It isn't a question anymore of how you can protect people from what's in the food supply, but rather one of how you can improve their health and their quality of life by changing the food supply. That gets into extremely complicated, very subtle kinds of changes that we have to understand.

*Q. If the food supply today is safer from a chemical standpoint, why is it more of a problem from a microbiological standpoint?*

A. It's a *very* complicated matter. A decade ago, a pathogen (a disease-causing bacterium or other microbe) made a toxin, and it made you sick. Identification seemed easy. You could purify it in a laboratory, develop a test for identifying it, and you were in business. Now we're faced with a host of newly emerging pathogens, because of advances in detection methods, and these pose a variety of scientifically complex problems.

We're also discovering that many of those viruses that we thought were associated with intestinal disease are, in fact, transmitted through contaminated food. We are better able today to detect these organisms. It only came about because we were able to apply the most contemporary genetic engineering techniques, what we call genetic probes.

The bugs themselves are changing. Every organism, every biological entity, evolves with time. With microorganisms, they tend to do that more rapidly because they reproduce themselves more rapidly.

What we're also beginning to learn is that the susceptibility to and severity of these diseases is a very complicated interaction between what you eat, what the nature of the organism is, how old you are, what physical condition you're in, and even your genetic makeup.

*Q. Diarrheal disease is seen as a worldwide public health problem. How prevalent is it in this country, and how much of it is of food-borne origin?*

A. Between one-third to one-half of all diarrheal cases in the United States - in fact, I would say, in all developed countries - is probably of food-borne origin. Douglas Archer and John Kvenberg (of FDA's Division of Microbiology) published a study that estimated that between 69 million and 275 million cases of diarrheal disease occur each year in the United States, and, of those, between 21 million and 81 million are of food-borne origin. Archer and Kvenberg were being totally conservative in their estimates. (See "The Public Health Threat of Food-Borne Diarrheal Disease," November 1985 issue of *FDA Consumer*.)

Now, even 20 million cases of diarrhea means that, on the average, one out of every 10 Americans has a case of food-borne diarrhea every year. I suspect it's much greater than that - that everybody in the country, at least once a year, has an episode of food-borne diarrhea.

*Q. If food-borne disease is so prevalent, what is its economic impact?*

A. The economic cost is unbelievable. We are talking about billions of dollars a year in direct costs alone - such as lost wages and medical treatment - without calculating the indirect costs to society. This is an incredible drain on our economy, yet people tend to ignore this. They say, "Hey, it's only a little diarrhea," or "There's something going around." A lot of those cases are going around all right, but they're going around because of tainted food.

*Q. Is the way food is produced today a factor in food-borne outbreaks?*

A. The concentration of the food industry itself is a factor. Years ago, when outbreaks occurred, only those people in a local market area were affected. Sometimes, an outbreak wouldn't even be reported to state health officials. Today, with small local factories - particularly small dairy plants - disappearing, you end up with one large factory impacting on millions of people all at once. So, if something goes wrong, bingo, you have 10,000 cases (of food poisoning). The best example is what occurred in Chicago.

*Q. You're referring to the Hillfarm Dairy?*

A. Yes. This was a state-of-the-art plant, everyone said. It replaced, when it was built, about 10 or so local plants. At least 2 million to 3 million people depended on this one plant for their milk. A glitch in the plant, and thousands upon thousands became very, very ill, and some people died. (The outbreak at the Hillfarm Dairy resulted in 16,284 confirmed cases of *Salmonella* food poisoning and at least two deaths from the consumption of contaminated low-fat milk. Some public health scientists estimate that as many as 200,000 people may have been stricken during the outbreak.)

*Q. There have been other outbreaks in recent years involving pasteurized products, primarily milk and cheese. Is there a problem with the pasteurization process? Is there a reason for the public to be concerned about the safety of milk?*

A. We've asked ourselves those questions too, and we are heavily involved in studying the issue. But, what it looks like at this time is that if milk is properly pasteurized, it will be protected. The problem that seems to occur, in most of these instances, is that either the pasteurization was not properly done or there was a mistake in the (production) system so that unpasteurized milk got mixed with pasteurized milk. The other problem is post-pasteurization contamination - contamination after a product is pasteurized.

Still another aspect to the problem is what I like to call the "boutique" food industry. In order to give it that

good old-fashioned taste, a little old cheese maker, for example, may add a little raw (unpasteurized) milk to his product. People go to food specialty shops looking for unpasteurized products. To me, that's Russian roulette of the worst kind. If you want to eat that, you have to accept the consequences.

*Q. Do you think the average person understands this whole issue of food-borne disease?*

A. No. Chemicals are high on the public's list of concerns, because chemicals are a frightening unknown to them. But we all have episodes of diarrhea, and we ignore them. "It must have been something I ate" or "I got the bug" - that's how people react. It's just part of life, they say, but they don't realize it is an avoidable part of life. What they also don't realize is that a susceptible population - young children, the elderly, the chronically ill, those that are malnourished - is more susceptible to the impact of these episodes than are healthy adults. That's where all the deaths occur.

The other thing of concern is that we are beginning to get hints that these episodes of food-borne disease can lead to a variety of chronic diseases. There are certain kinds of arthritis that may be associated with these organisms. There is a possibility that some of these organisms may, in fact, have the ability to change substances in food and convert them into carcinogens. To pass these things off as being a part of the small irritations of life is ludicrous.

*Q. How do you get the public to become concerned about food-borne disease?*

A. That's an excellent question. The answer is we haven't done it very well. It doesn't matter what we say or what data we show. The fact is, people don't want to believe us. I suspect there are several reasons for this. For example, the role of the media. It's much easier (for the press) to raise unknown, mysterious questions about these terrible chemicals. Everyone knows that chemicals are "dangerous." For example, hydrochloric acid. We know that's a "dangerous" chemical, right? It burns you. But we produce hydrochloric acid in our stomachs every day.

It's such lack of public understanding that the press contributes to. It makes scare headlines like: "TOXIC CHEMICAL FOUND IN FOOD." While there may be only a trace, just a barely measurable amount, the press will give you the impression that it's enough to cause immediate death. I have no solution to the problem, since I am a firm believer in the First Amendment.

*Q. An outbreak of listeriosis in California last year claimed some 100 lives and resulted in the destruction of 1.5 million pounds of cheese. FDA collected 850 cheese samples, made 600 recall checks, and spent more than 1,500 hours in inspections. That's what we did in response to an outbreak, but what's being done to prevent such occurrences?*

A. When you talk about 1,500 hours, what most people don't consider is that that effort is concentrated in a very short time. Which means we have hundreds



of people attempting to deal with an outbreak because we've got to get control of it as quickly as possible. We have to identify the origin (of an outbreak), the cause, where the contaminated food was shipped, who's got it. It's a real problem and it takes a lot of effort.

Routinely, we have inspectors who are trained in various food plant operations. We tend to target plants. We tend to look for those plants that are producing products that are potentially hazardous compared to those that aren't. For example, we will spend more time in a low-acid canned food plant than, for example, in a bakery. Why? Because low-acid canned foods are those in which botulinum might grow more readily. It's hard for anything to happen to bread. We will target more dairies than food warehouses. We don't have enough resources to check them all to the extent we should, so we concentrate inspections where we think the hazards more likely are.

*Q. How much is FDA spending on microbiological problems?*

A. Right now, it's about 43 percent - approximately \$54 million - of our budget for the Center for Food Safety and Applied Nutrition (908 out of 2,003 positions in the center are devoted to food-borne biological hazards). It's the largest of our programs.

*Q. In view of current budget restrictions, what hard decisions is FDA facing on resource allocation?*

A. One of the responsibilities the agency has always had is to protect the public from fraud. But one of the decisions we're having to make is how much we do on fraud compared to that which endangers health. How much work do we do on making sure labeling is accurate compared to dealing with something that may hurt people?

*Q. All of this seems to imply a need for the agency to have a stronger public education effort on food-borne disease.*

A. The agency has always had a strong commitment to public education. The problem is that we must give higher priority to an acute crisis, our regular inspection and research activities, and other public health concerns. There are things we are doing, but the problem is: How do you break down generations of prejudice, predetermined and incorrect views of what's going on? I don't think we spend enough money on research on how to change attitudes. If we knew how to do that, maybe we could get people to think more rationally about their food supply.

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# Conclusions and Recommendations 1986 Conference for Food Protection

## Executive Summary

The following is a summary of the conclusions and recommendations presented by technical committees and approved by the Conference for Food Protection held in Ann Arbor, Michigan, August 17-20, 1986. Because this summary leaves more unsaid than said, it is not to be taken as the official record of the Conference proceedings. The complete record will be published in the official proceedings under the title, "Food Protection Technology," to be published by Lewis Publishers, Inc. of Chelsea, Michigan in January, 1987.

### TOXICOLOGY

Current methods of quantitative risk assessment are useful because they can identify reliable upper limits of likely human risk and thus support judgements in some cases that the human risk is insignificant. Current methods are quite imprecise, however, due to the assumptions necessarily relied upon to compensate for gaps in knowledge. There is thus a need for a well-planned effort, including research, scientific consensus-building and other activities, designed to enhance the precision of risk assessment by replacing the current assumptions with real knowledge.

The following recommendations are based on the 1984 recommendations of the Second National Conference for Food Protection, but go beyond them. They are intended to suggest some more specific steps that can be taken toward improving the science of risk assessment and assuring that toxicology plays its full, appropriate role in food safety decision making.

### RECOMMENDATIONS

1. We recommend that risk assessors attempt to provide, and that regulatory agencies make publicly available, both upper limits and most probably estimates of risks.
2. We recommend the establishment of a blue-ribbon panel to provide leadership and coordination within the area of risk assessment research.
3. In the case of food packaging materials, the totality of existing toxicological data on the carcinogenic potencies as well as non-carcinogenic toxicities of potential migrants should be compiled and summarized so that upper bounds can be placed on migration levels and risks that are consistent with and define a "threshold of regulation".
4. We encourage the formulation and active discussion of general rules for interpreting the human significance of tumor data in laboratory animals.
5. The role of epidemiology in food safety evaluation should be better defined.... Data should be included on a weight of evidence basis.... National human nutrition surveys should concentrate on exposure to food constituents and long-term health outcomes in the same individuals.
6. Methods to bring parties together to strive for consensus about risk assessment needs development through the blue-ribbon panel or others.
7. The "OSTP cancer guidelines" should be updated as research makes change possible.
8. Regulatory agencies should be provided sufficient resources to carry out their own research and development activities and maintain capacity to interpret results produced by others.
9. Regulatory agencies should be provided sufficient resources to carry out their own research and development activities and maintain capacity to interpret results produced by others.
10. We support more work in the area of the 1984 recommendation (toxicology #2) suggesting that it should be possible to improve high-to-low dose extrapolation...by using techniques that incorporate more compound specific biological information.
11. There appears no reason to change the current NOEL-safety approach to non-carcinogenic risk assessment.

### MICROBIOLOGY

### RECOMMENDATIONS

*On Hazard Analysis Critical Control Point (HACCP) Methods:*

1. The Conference should endorse and promote the use of the HACCP concept in food protection programs.
2. Government, academia, and industry should work together to develop training and resource materials for government and industry to use in implementing HACCP programs.
3. Research must be carried out to provide greater flexibility in the criteria for cooling potentially hazardous foods; to develop equipment and procedures to meet these criteria; and to define the practical use of pH and water activity as monitoring procedures for control points.

*On Rapid and Automated Methods:*

1. Strong efforts should continue in the development of more sensitive and specific test methods.
2. Research efforts should be aimed at procedures to de-

fect virulent food pathogens within 8 hours or less.

3. Research should be directed to simplify or automate new technologies that are inexpensive and not labor intensive.
4. Research is needed to improve enrichment procedures; filtration techniques.
5. We need to take a closer look at total plate count and at the relevance of bacterial numbers in measuring food quality.
6. Alternatives to the BAM procedures should be considered.

#### *On the Applicability of Microbiological Criteria:*

1. The establishment and implementation of a microbiological criterion for a food or ingredient in the U.S. only when there is need and when it can be shown to be effective and practical.
2. Endorsement of the National Research Council's plan for a national program to identify foods for which microbiological criteria are needed.

#### *On Pathogens and Toxins:*

1. The processing of dairy foods needs to be evaluated for its efficacy in preventing the survival of pathogens.
2. Research is needed to identify means of controlling foodborne transmission of emerging pathogens.
3. Alternate preservation systems for newly formulated products should be evaluated for microbiological safety before products are introduced to market.
4. The public and food industry employees should be made aware of the potential hazards of animal-derived raw foods; and the need for rapid cooling or hot holding of foods following cooking.
5. Innovative and effective techniques should be instituted for the education of primary and secondary students on food safety.
6. Regulations should be promulgated to prohibit the distribution of milk and milk products for consumption before pasteurization; this deserves priority action at once by state regulatory authorities.
7. The Conference calls for development of better methods for detecting human gastroenteritis viruses in clinical specimens and foods; recommends establishment of a reference laboratory to that end.
8. The Conference urges reduction of spills and untreated wastewater discharged into rivers and the sea to prevent contamination of seafoods.
9. Seafood toxins require research into better methodology for rapid methods, identification of dinoflagellates that produce them, surveillance techniques, control methods, and development of specific antidotes.
10. Water used in food processing should be of adequate microbial quality.

#### *On Surveillance:*

1. National foodborne disease data should be placed into "confirmed," "presumptive", and "suspect" categories; should include information from FDA, USDA, and other federal agencies; and the Centers for Disease Control should make a concerted effort to adequately analyze the data and present it in a more timely and more usable fashion.
2. Health agencies should provide training to medical personnel about the need to properly report and investigate foodborne illness.
3. Improve communication between public health agencies and from public health agencies to the medical community and the public.
4. Local health agencies need to focus on foodborne illness investigations, evaluation of data gathered, and prevention.
5. Local health agencies have to be flexible in their working hours to ensure that *all* food operations are evaluated.
6. The Conference recognizes the importance of animal traceback and endorses activities that encourage systems for tracing animals through the food chain.

#### *On Measurement of Economic Loss:*

1. Cost benefit studies should be conducted to assist government and industry in evaluating options to solve food contamination problems.
2. An organization should promote interest in collection of data by setting up a study with representatives of affected organizations to clearly define food losses.

### *GOOD MANUFACTURING PRACTICES AND QUALITY CONTROL*

#### *RECOMMENDATIONS*

1. That the Board establish a task force to develop methods for cooperation between industry and food regulators for training and education programs to support the HACCP concept.
2. That the Board develop a means to provide a list of rapid methods used for in-process HACCP analyses; and a clearing house for new methods.
3. That processes carried out for microbial control be validated before they are put into use, after changes are made, and annually.
4. That basic food safety be reinforced in the educational system and to the general public.
5. That the Education and Training Committee encourage internships for food science and engineering students.
6. That the Board compile a list of texts and training programs covering HACCP principles; that the need for additional materials be brought to the attention of the National Sanitation Foundation and others.
7. That USDA grading standards for grains be reflective

of current FDA defect action levels.

8. That the Board form a task force to evaluate potential hazards in the food transportation system.
9. That the Board establish a task force to study a means for trace-back to point of origin of all food ingredients.

#### STANDARDS AND REGULATIONS

The Conference recognizes the need for a model unicode for food protection in retail food establishments and the need for key national organizations, regulatory and industry, to work with FDA on a cooperative and consensus basis.

#### RECOMMENDATIONS

##### *On A Model Unicode:*

1. The Conference endorses the development of a model unicode.
2. The Conference endorses the cooperative consensus approach.
3. Industry should be given a vote at the committee level.

##### *On Quantitative Risk Assessment:*

1. The Conference recognizes the potential benefits of an expanded quantitative risk assessment model as described in Robert L. Sielken Jr.'s white paper on the topic.
2. Methods reflecting biologically effective dose scales, age and time dependent changes, cell proliferation and distributions of individual susceptibilities, and background doses should be examined in order to determine whether they can usefully be incorporated into current risk assessment practices.

#### EDUCATION AND TRAINING

#### RECOMMENDATIONS

1. The Conference endorses the creation of a standardized food service plan review process.
2. The Conference will request the National Sanitation Foundation to create a task force to establish uniform plan review processes.

#### NEW FOODS, PROCESSING, AND PACKAGING

#### RECOMMENDATIONS

##### *On Irradiation Processing:*

1. Encourage research and assessment of public health problems that would be best eliminated by use of ir-

radiation technology.

2. Promote the adoption of the "General Codex Standard for Irradiated Foods and the Recommended International Code of Practice for Operating Radiation Facilities for the Treatment of Food".
3. Assist IAEA in the expansion of the data base on radiation sterilization of food with doses above 10kGy.

##### *On Aseptic Processing of Particulates:*

1. Promote a workshop to identify research needs and develop priorities and implementation for aseptic processing of particulates.
2. Encourage the Education and Training Committee to address training of operators and supervisors of aseptic systems.

##### *On Genetic Engineering:*

1. Prepare a position paper on research needs for genetically engineered food for wide distribution.
2. Prepare a similar paper on regulatory considerations for genetically engineered foods.
3. Develop an educational liaison activity to provide scientific lecturers on genetic engineering topics.

##### *On Novel Processes:*

1. Promote development of a framework to be used to evaluate the safety and regulatory aspects of novel processes and products.

##### *On Food-Package Interactions:*

1. Establish a consortium to secure and administer funds to support extraction methodology, improved solvents and food simulants for plastics testing and fundamental research on the diffusion and solubility of plastic packaging construction materials.
2. Establish a clearing house and data base on diffusion and solubility of plastic package construction materials.

#### CONFERENCE PROGRAM

#### RECOMMENDATION

1. Establish a state regulatory ratification section within the government council whereby each of the 50 states will have one vote.
2. The first of three amendments to the Conference's articles of incorporation which IRS regulations require before the Conference can qualify to tax exempt status.
3. The second amendment.
4. The third amendment.

### Computer-Aided Cheese Tasting Underway At UW-Madison

Computers can't taste--can they?

Not yet. But a University of Wisconsin-Madison food researcher is using a computer program's recommendations to develop cheese toppings that possess the main ingredient for market success: consumer acceptance.

Veronique Hanrez-LaGrange is investigating new flavors for processed cheese toppings. Her electronic assistant, Senspro, can evaluate the opinions of thousands of human taste-testers, determine the testers' favorite flavor combinations, and recommend the most efficient way to achieve them.

Food scientists developing new products and manufacturers vying for market share depend on data obtained from "sensory evaluations," which are scientifically conducted taste tests. Senspro offers a fast, efficient way to appraise that information and put it to work, she says.

At the UW's Babcock Dairy Store, volunteers sampled cheese toppings ranging from bacon and hickory smoke (an eventual winner) to nacho and olives (a flop). They rated them on texture, flavor intensity, freshness and overall tastiness.

Senspro examined responses and recommended ingredient adjustments as the study proceeded. "The project was a series of evaluations and refinements," Hanrez-LaGrange says. "Consumer responses to variations in formulation during product development are essential to the process."

After analyzing data from consumer responses, Senspro can produce a graph showing, for example, the ideal amount of chives to add to a topping. The program can make recommendations dealing with four or five variables, using vectors instead of graphs.

Senspro also works quickly. "If I had to tabulate all that data, perform the calculations and make the graphs, it would take days. Senspro takes minutes," Hanrez-LaGrange says.

This project is much more than an academic exercise, she points out. Most specialty cheeses are now imported. The domestic specialty-cheese market will use a lot of Wisconsin cheese, butter and whey if manufacturers can market products with the flavors and other qualities people desire. Manufacture doesn't require a massive capital outlay, she adds.

The toppings are made of cheddar cheese, water, butter, whey protein concentrate from milk, natural flavorings, and emulsifiers to prevent fat separation. They contain no added preservatives, artificial colors

or flavors, and have about half the fat of regular cheddar cheese.

The versatile toppings can be used cold or warm, as sauces, dips or spreads, toppings on hot vegetables or potatoes, and ingredients in soups and casseroles. They're spreadable straight from the refrigerator, spoonable at room temperature, and pourable at 100 degrees. They freeze well and can be heated in a microwave.

"You could call them 'dairy convenience foods,' but without preservatives," she says.

Hanrez-LaGrange used nearly 4,000 people's taste opinions to develop four topping flavors. "We were also testing the computer program," she explains. "In a manufacturing setting we could proceed more quickly, because we could skip some of the testing steps to get to the final recommendation." This was one of Senspro's first uses in step-by-step product development. Several manufacturers are now using the program.

Senspro was developed by John Norback, a UW-Madison professor of food science and director of WISPLAN, UW-Extension's statewide computer service. Hanrez-LaGrange discussed her findings at the Cheese Research and Technology Conference held recently in Madison.

### Sanitation, Cooking Keys To Avoiding Salmonella On Poultry

Proper handling and cooking are the keys to avoiding *salmonella* poisoning from poultry, says a Texas Agricultural Extension Service official.

Dr. James Denton, a poultry marketing specialist, says recent U.S. Department of Agriculture report "pointing the finger" at *salmonella* bacteria in chickens states a situation that is not unusual. The report noted that almost four of every 10 chickens sold to consumers are contaminated with *salmonella*, bacteria that cause flu-like symptoms of fever, diarrhea and vomiting for two to seven days and may even cause death.

Denton points out that the poultry industry is aware of the problem and that proper processing eliminates 95 percent of the bacteria on a live bird. "Further decontamination would be prohibitively expensive or require certain techniques, like chemical dips or irradiation, that the public might not accept," he says.

"Salmonella can be killed by heat during proper cooking," explains Denton, "and thorough washing to hands after handling uncooked meat can help prevent contamination."

Denton recommends that consumers follow the "four Cs" to avoid potential salmonella problems with chicken: maintain "clean" working areas for handling poultry, "cook" poultry thoroughly to kill bacteria, "chill" meat as quickly as possible following cooking and serving, and don't "cross-contaminate" cooked meat with bacteria from raw meat.

All animal food products contain bacteria of one form or another, the specialist points out, and most of these are removed by proper cleaning and sanitation. "To grow and multiply, bacteria must have proper nutrients, adequate moisture, proper temperature and adequate time," says Denton. "Removing any of these ingredients will keep bacteria counts in check.

"If poultry is to be stored under refrigeration, keep it at 40 degrees F. or less," advises Denton. "when keeping poultry warm for serving, hold it at 140 degrees F. or greater. Keep the holding time of poultry between 40 and 140 degrees F. to an absolute minimum."

The specialist emphasizes that the work area for handling both raw and cooked poultry should be kept as clean as possible. Also, every effort should be made to prevent cross-contamination or recontamination of fully cooked poultry meat with raw meat or bacteria from raw meat.

"Never use a cutting board, platter, knife or other utensil or container that has been previously used for raw poultry meat without completely cleaning with soap and hot water prior to using them to handle or store cooked poultry meat," advises Denton.

### ***Food & Dairy Expo '87 Breaks All Records For Space Requests***

Food & Dairy EXPO '87 is seven months away from opening day and has already broken all previous records for space reservations. Four hundred forty-two members of Dairy and Food Industries Supply Association (DFISA) have reserved more than 275,000 square feet of exhibit space at McCormick Place, Chicago, Illinois, September 26-30, 1987.

The five-day show will provide practical information to a road spectrum of individuals from the food, dairy and beverage industries. At least 17,000 top industry executives, including manufacturing managers, engineers, researchers and marketing/sales personnel are expected to attend.

Many leading allied industry associations will hold meetings during EXPO week. They include: International Ice Cream Association; Milk Industry Foundation; National Ice Cream Mix Association; National Ice Cream Retailers Association; Food Industries Suppliers Association; American Society of Agricultural Engineers and International Dairy Federation.

Food & Dairy EXPO '87 is one of only 15 trade shows chosen to participate in the Foreign Buyer Program sponsored by the U.S. Department of Commerce, International Trade Administration.

For more information on attending or exhibiting at Food & Dairy EXPO '87, contact Dairy and Food Industries Supply Association, 6245 Executive Boulevard, Rockville, Maryland 20852. Telephone: 301-984-1444.

### ***Raw Fish Is A Food Safety Hazard***

It's hard to go wrong with high-protein, low-calorie fish--unless you eat it raw.

"The growing popularity of undercooked fish or raw fish dishes such as sushi, sashimi, ceviche and others has resulted in an increase in cases of disease attributable to fish parasites," says food safety expert Marilyn Haggard.

"Properly canned or frozen fish pose no danger of infection," notes the Texas A&M University Agricultural Extension Service specialist.

Cooking fresh fish until all parts of the fish have reached a temperature of 145 degrees Fahrenheit will also kill parasites, she adds.

"Frying, baking or broiling fish until it flakes with a fork is still good advice," Haggard says. "Fish that is so lightly broiled or sauteed that it's still translucent in the middle may be called a gourmet dish, but it could also be dangerous."

According to the specialist, brining and hot smoking are other methods that kill parasites, while cold smoking which uses no heat, will not.

"Commercially prepared lox, or smoked salmon, is both brined and smoked," she notes. "But ceviche can be hazardous because the lime juice used in the marinade may not kill all parasites."

Haggard says that freezing fish at minus 4 degrees Fahrenheit for 3-5 days will also prevent illness.

Given the health risks involved, consumers would be wise to avoid raw or undercooked seafood, stresses the specialist.

## ***New Exposition Devoted Exclusively to Industrial Liquid Handling Scheduled For July 1987***

Liquitec Expo '87, the first exposition devoted exclusively to industrial liquid handling, has been scheduled for July 28-30, 1987 at the Philadelphia Civic Center, Philadelphia, PA. The show spotlights the technology and products used for the handling of all types of industrial liquids. The specific theme of the show will promote a vast exchange of ideas and needs through face-to-face contact.

This multi-industry event is aimed specifically at buyers and specifiers of liquid handling products and services in every manufacturing industry. Attendance is expected to exceed 10,000 qualified buyers, specifiers, and liquid process engineers along with 350 exhibitors. In addition to the exhibits, Liquitec Expo will also feature technical workshops on July 27th and educational seminars July 28-30 presented by industry experts. The emphasis will be on new and important technologies in industrial liquid handling.

For further information, contact: Liquitec management; Liquitec Expo, Inc., P.O. Box 630, Wet Paterson, NJ 07424. Telephone: 201-256-0011.

## ***Report Assesses Impact of EEC Packaging Directive***

A new report - Packaging, Environment and Recycle: A Scientific Assessment - gives the first detailed and comprehensive analysis of the issues surrounding packaging and the environment.

The report covers all aspects of the topic - environment, waste, resources, recycling, degradability, legislation and regulations - and details the complete packaging cycle, examining the different stances of manufacturers, environmentalists and government authorities.

The report should be read by all those concerned with the governmental, academic, political and industrial aspects of packaging and waste management; particularly in view of the implementation of EEC Directive 85/339 (the "Beverage Containers" Directive), the planning programmed deadline for which coincides with the reports publication.

Packaging, Environment and Recycle is written by Dr. Leonard Katan, former member of the British Government's Waste Management Advisory Council's Packaging and Containers Group. It is published by Elsevier International Bulletins, who also publish the leading international newsletter Food, Cosmetics and Drug Packaging.

For more information, contact: Caroline Ashly, Elsevier International Bulletins, Mayfield House, 256 Banbury Road, Oxford OX2 7DH, UK. Telephone: Oxford (0865) 512242; International: (865) 512242.

## ***Hackman-Mkt Inc. Founded to Combine the Operations of Hackman Flow, Inc. and St. Croix Valley Engineering, Inc.***

Three large Finnish companies, Oy Hackman Ab, Hankkija co-op and Valio co-op have established a new company HACKMAN-MKT OY to combine the products and services of Hackman's Flow Division, Mkt-tehtaat Oy and Erkomat Oy. OY HACKMAN AB, with 1985 sales of over \$200 million, becomes the majority share holder of the newly formed company, headquartered in Helsinki, Finland.

Hackman Flow Division products have been imported and distributed in North America through Hackman Flow, Inc., of Brunswick, Georgia and MKT-tehtaat evaporator and spray dryer products have been distributed in the United States by St. Croix Valley Engineering, Inc., of Hudson, Wisconsin. The U.S. company, a wholly-owned subsidiary of Hackman-MKT Oy, will be known as HACKMAN-MKT INC, and will combine the following products and services to North American customers:

*Hackman Flow Division* products include a full line of fluid and material handling equipment for the food processing, pharmaceutical, and chemical industries. Among the products are the highly accurate and versatile mechanical and magnetic flow meters, and the patented KOLTEK valve.

*MKT-Tehtaat Oy*, previously a subsidiary of Hankkija Co-op, brings to this new company a product mix consisting of evaporators and spray dryers, including complete turnkey projects and engineering design.

For further information, contact: Mr. Markus Nymark, Hackman-MKT, Inc., Route 3, Box 28, Brunswick, GA 31520. Telephone: 912-264-0950. Or, Mr. Michael Catto, Hackman-MKT, Inc., P.O. Box 29, Hudson, WI 54016. Telephone: 715-386-9501.



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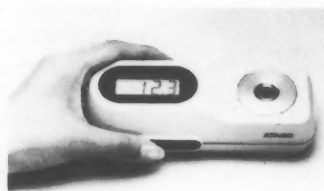
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The PR-1 has a minimum Brix indication of 0.1% and a measuring accuracy of  $\pm 0.2\%$ . Total measuring time is 3 minutes, and a sample volume of only 0.1 ml is required. The unit is controlled by an internal microcomputer; it also features automatic temperature compensation, a large easy-to-read liquid crystal display as well as an optical sensor for automatic measurement.

For more information, contact: S. Schoenfeld, 195G Central Avenue, Farmingdale, NY 11735. Telephone: 516-249-7474.

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### New Broken Bag Detection - No Maintenance

• Maintenance free, low-cost and reliable detection of bag rupture and filter failure is now available with the Triboflow® System from Auburn International. Providing accurate and effective monitoring of filter outlets for breakthrough detection, the Triboflow is the only instrument available that utilizes triboelectric technology to monitor dry solids flow. The friction of particles passing over Triboflow's probe transfers a charge which is electronically compared with an adjustable preset norm. Any significant increase in the normal signal level triggers a contact closure which can activate an alarm.

This principle of operation permits Triboflow to directly detect tears, ruptures, or failures, in bag houses or filters quickly and more accurately than any available device. Additionally, Triboflow's alarm time delay feature prevents false signals due to normal dust fluctuations and bag cleaning. Triboflow sensors can easily be installed in hazardous locations and have no moving parts.

The Factory Mutual approved, intrinsically safe Triboflow is the only non-optical, non-inferential broken bag detector available. The easily maintained Triboflow is currently being used to detect upsets successfully in such varied applications as detection of chemical dust, plastics dust, milk drying, cement dust, pharmaceuticals, fly ash, and a wide range of other dry solids processing applications. The Triboflow is available in single sensing and multi-sensing versions.

For more information on Auburn's line of Broken Bag Detectors, contact: Auburn International, Inc., Eight Electronics Avenue, Danvers Industrial Park, Danvers, MA 01923. Telephone: 1-800-255-5008 or 617-927-7222.

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### ADS-1 High Speed Spoiled Product Detection System

• Clayton Durand Manufacturing Company, Inc., Durham, North Carolina announces the availability of their ADS-1 high speed spoiled product detection system.

Available as a modular unit or conveyor mounted the ADS-1 uses optical means to detect the occurrence of spoiled dairy product. This approach is founded on the observation that spoilage causes subtle changes in color and/or flocculation properties. The qualitative and quantitative changes are best observed in a reflectance mode using the greater penetrating power of the longer wavelengths of light. Differences in reflected, invisible light in the near-infrared range are therefore measured by differential, multiwavelength laser spectrometry.

Requirements of speed, safety, and wavelength specificity are met by employment of pulsed laser diodes as radiation sources. (These class B lasers rank lowest in hazard; in addition they are provided with shut off features that preclude accidental, direct viewing.) Ambient light rejection is enhanced by ultra short pulsing a fraction of a millionth of a second at high repetition rates. Appropriately tuned and time-locked circuitry in the detector and signal treatment electronics further insures signal specificity. Sample and hold techniques are used to compare the measurement of each sample (i.e. an individual bottle) to a predetermined standard of quality.

The ADS-1 spoilage detection system is designed to scan individual containers and packages at production speeds. Defect product is ejected from the line or a signal to machine shut down is energized. The ADS-1 is adjustable to scan a full range of containers and packages up to seven hundred (700) per minute.

For further information, contact: Martin Cicchelli, President, Clayton Durand Manufacturing Company, Inc., 2402 Reichard Street, Suite A, Durham, NC 27705. Telephone: 919-471-4457.

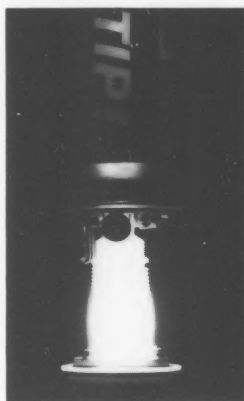
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### BacTrace® Affinity Purified Antibody to Salmonella

• KPL's BacTrace® antibody to *Salmonella* is specific for common structural antigens of the genus *Salmonella*. The antibody is produced in goat, then affinity purified to minimize cross reactivity to members of *Enterobacteriaceae* other than *Salmonella*. The antibody is highly sensitive to *Salmonella*, and reacts with all 83 serotypes tested in our laboratory. This product is available either unlabeled or labeled with peroxidase, phosphatase or fluorescein. These antibodies can be used individually or in tandem for rapid detection of *Salmonella* in human and veterinary clinical specimens as well as food, cosmetic and pharmaceutical samples. Bulk production is available for large scale applications.

For further information, contact: Susan Wetherell, Microbiology Manager, Kirkegaard & Perry Laboratories, Inc. 2 Cessna Court, Gaithersburg, MD 20879-4145. Telephone: 301-948-7755.

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### New Photoionization Lamps

• Users of Photovac's award winning 10S portable G.C.s and Tip air analyzers may now select detector lamps from the most complete range of energies available today (8.4 eV, 9.5 eV, 10.2 eV and 11.7 eV). All Lamps are in-

terchangeable in existing Photovac instruments. This significant achievement saves thousands of dollars compared with previous technology, while providing improved sensitivity and specificity for a wider range of chemical compounds.

For more information, contact: Photovac International Inc., 741 Park Avenue, Huntington, NY 11743. Telephone: 516-351-5809.

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### Two New Antimicrobial Test Discs for Sensi-Disc System: Norfloxacin and Aztreonam

• BBL Microbiology Systems announces the introduction of Norfloxacin 10mcg and Aztreonam 30mcg susceptibility test discs to the BBL® Sensi-Disc® System. They join recent BBL additions of Cefaclor and Imipenem discs, providing laboratories and physicians with the latest tools for determining antimicrobial susceptibility.

BBL Sensi-Disc susceptibility test discs, representing antimicrobial agents manufactured and marketed by leading pharmaceutical companies, are available in single cartridges of 50 discs and packages of ten cartridges. Each cartridge is blister-packed with a desiccant to ensure optimal potency and performance in susceptibility testing. The BBL Sensi-Disc susceptibility test disc cartridges, when used in the 12-place self-tamping dispenser, can improve laboratory work flow by eliminating the need to individually tamp discs.

The BBL commitment and proven track record in the development and rapid introduction of new antimicrobial test discs continue to make the latest in susceptibility testing available to the laboratory and the physician.

For more information, contact: Dorothy Steltzer, Advertising Media Specialist, BBL Microbiology Systems, P.O. Box 243, Cockeysville, MD 21030. Telephone: 301-771-0100, extension 2304.

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## RAW CLAM ASSOCIATED GASTROENTERITIS - SUFFOLK COUNTY

An outbreak of gastroenteritis occurred after a dinner at a Suffolk County country club on April 20, 1986. After an initial reluctance from the country club management to furnish a guest list for the event was resolved, Suffolk County Health Department personnel interviewed 64 of the 109 persons attending the dinner, and found that 28 persons became ill. Nausea, diarrhea, and cramps were the predominant symptoms. The mean incubation period was 38 hours (range 4-62 hours) with a mean duration of 62 hours (range 12-120 hours). Immune globulin shots were recommended to all who ate raw clams at the event.

An analysis of food consumption histories of the 64 persons interviewed showed raw clams to be statistically associated with illness ( $p < 1 \times 10^{-5}$ , Fisher's Exact Test). When each food's attack rate was analyzed separately, consumption of several additional foods appeared to be significantly associated with illness. However, when attack rates for these foods were adjusted to exclude persons who also ate raw clams, only consumption of raw clams remained significantly associated with illness.

A food preparation review failed to identify any food handling practices at the country club that could have contributed to this outbreak.

The clams served were purchased by the country club on April 29, 1986 from Quality Fish, Inc. Records indicate that the clams were purchased from North American Shellfish, Brightwaters, New York (NY 838 55) who in turn purchased them from Atlantic Shellfish, Bristol, Rhode Island (RI 218 55). Staff of the Stonybrook Regional Office of the New York State Department of Environmental Conservation examined shipper's records and confirmed the chain of sale/distribution. The clams were harvested from Narragansett Bay, Rhode Island.

No clams remained to be examined for bacterial pathogens. No stool or blood specimens were collected.

On May 16, 1986, Dr. Axelrod issued an embargo order prohibiting service of Atlantic Shellfish hard-shell clams in any food service in New York State. According to the embargo order, hardshell clams from Atlantic Shellfish are considered to be "unfit for human consumption" and Atlantic Shellfish is an unapproved source of hard-shell clams.

### Editor's Note

Gastroenteritis outbreaks related to consumption of raw shellfish are presumed to be of viral etiology on the basis of incubation period (24 to 48 hours), duration of illness (24 to 48 hours), self-limiting nature of the symptoms, and negative findings of bacteriologic studies. Commonly, symptoms include diarrhea, nausea, abdominal cramps, and vomiting. Norwalk virus outbreaks normally can be confirmed by a four-fold rise in IgM antibody to Norwalk virus in paired serum samples (acute and convalescent sera). Such confirmation is time consuming and expensive. Bacteriologic studies of fecal specimens and leftover foods are rapid and cost effective. While negative bacteriologic results in most foodborne disease outbreak investigations can be a disappointment, negative bacteriologic results from a suspected viral outbreak are an important addition to the investigation and support the viral hypothesis by eliminating likely bacterial etiologies. Every effort should be made to collect stool specimens for bacteriologic examination for all suspected foodborne disease outbreaks, even when a viral etiology is suspected.

- Food Protection Bulletin - N.Y.  
State Dept. of Health  
Vol. 2, No. 6 (1986)

## FDA DEFINITION OF POTENTIALLY HAZARDOUS FOOD

An FDA Retail Food Protection Program Information Manual item titled, "Definitions - Potentially Hazardous Food," was issued in May 1986. This item is a valuable technical reference for anyone involved in food inspection. The reference discusses factors that can be used to determine if a food is potentially hazardous and includes nutrient content, water activity ( $a_w$ ), hydrogen ion concentration (pH), biological structure, intrinsic factors (such as natural antimicrobials), and extrinsic factors (temperature, oxygen, time and light). A table listing the effect of combinations of temperature, pH and  $a_w$  on the growth of *Clostridium botulinum* Type B is included and is helpful to analyze the concept of interactions of these factors into perspective.

The way each factor affects the growth of pathogenic microorganisms in foods of plant origin is particularly informative. Most food inspection personnel are already familiar with the classic potentially hazardous foods such as meat, milk, eggs, poultry and fish. Recent outbreaks of foodborne disease with vegetables or fruit as a vehicle necessitates some exploration of the ability of these foods to be potentially hazardous. This reference concentrates on the possibility of growth of pathogenic bacteria on vegetables and fruit.

- Food Protection Bulletin - N.Y.  
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## CRYPTOSPORIDIOSIS - A "NEW" CAUSE OF GASTROENTERITIS

Over the last few years, *Cryptosporidium*, a protozoan parasite, has been shown to be a cause of diarrheal disease in humans. The symptoms are watery diarrhea lasting 3 to more than 14 days, with vomiting, anorexia and abdominal pain. Infection may be asymptomatic or mild to severe. Incubation period is not precisely known but is probably about 10 days. The organism infects the intestinal epithelium, resting on the surface of the intestinal cell and multiplying by schizogony; development of gametocytes among these surface forms results in resistant and long-lived oocysts which pass out in the feces. Oocysts, which are only 4-6 microns long, have been shown to remain infective for 2-6 months in a moist environment.

The mode of transmission is fecal-oral and the possibility exists that it may be spread by food or water. Cases of cryptosporidiosis have been linked to travel to countries such as Mexico, the USSR, Central America, South America, southern Asia, Africa and Europe and, hence, cryptosporidiosis should be regarded as one cause of Travelers Diarrhea.

Cattle and other domestic and wild animals may be reservoirs putting animal handlers at a high risk of exposure. In one study in Australia, the parasite was present in 4% of gastroenteritis patients who were not immunocompromised. In immunocompromised patients, especially those with AIDS, the incidence has been shown to be as high as 26%.

It appears that careful handwashing will be the best control measure for a food service setting and in day care facilities. There have been reports of outbreaks in day care settings from Pennsylvania, Michigan, Georgia, Minnesota, New Mexico and California in late 1984.

Identification of the organism in stool has only occurred when specific tests for *Cryptosporidium* were performed; it is not verified doing a parasite screening test and must be specifically requested. If cryptosporidiosis is suspected, sampling and testing protocols should be reviewed with the Department's Food Protection section before sample submission.

- Food Protection Bulletin - N.Y.  
State Department of Health  
Vol. 2, No. 5 (1986)

## CONFIRMING AN OUTBREAK - PATIENT SPECIMENS

All too often, the lab receives a cooler full of food samples from an outbreak investigation but no patient specimens. While it is possible to confirm an outbreak with food samples alone on occasion, the odds of confirmation go way up when patient specimens are submitted too. In fact, if one had to choose between food or patient specimens (stool or vomitus) as the one item to submit, one would have better odds for a confirmation with patient specimens alone. Why? For one thing, a vomitus or stool specimen may represent a collection of all of the foods a victim may have eaten, while food specimens may not represent the suspect food at all. Collection of patient specimens, while requiring much tact and skill at a personal level, is well worth the extra effort.

A frequent complaint heard from outbreak investigators is that the victims had recovered before specimens could be collected. Why bother collecting stool specimens from a healthy person? The following list, compiled from the 14th Edition of *Control of Communicable Diseases in Man*, demonstrates how long certain foodborne disease agents can continue to be excreted in the feces of a victim:

*Salmonella* - Several days to several weeks, even months - especially from children.

*Campylobacter* - Two to seven weeks - chronic carrier state unusual.

*Yersinia* - Fecal shedding is at least as long as symptoms - untreated cases may be for 2-3 months, chronic carriers exist.

*Cryptosporidium* - Oocysts, the infective stage, may be excreted in stool for several weeks after symptoms resolve.

*Rotavirus* - Up to 23 days after illness onset but usually undetectable after 8 days.

*Clostridium perfringens* - May persist for weeks after symptoms, usually  $10^4$  or fewer per gram of feces from healthy individual while  $10^5$  per gram or more from outbreak victim.

Lastly, the fact that stool specimens are negative for bacterial pathogens can be used to support the hypothesis of a viral agent and thus become a valuable addition to an investigation.

- Food Protection Bulletin, N.Y.  
State Dept. of Health  
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## STREPTOCOCCAL PHARYNGITIS OUTBREAK - ONTARIO COUNTRY

For the second year in a row, the Geneva District Office of the New York State Health Department has managed to report an outbreak that will be tough to beat for the annual "It Must Have Been Something I Ate" award. Last year, it was the *Campylobacter* outbreak. This year it is an outbreak of streptococcal sore throat that appears to be associated with a meal at a bridal shower.

On May 27, 1986, a complaint was received by the Geneva District Office that several people had become ill after attending a bridal shower at a local country club on May 18, 1986. Symptoms were reported to include a severe sore throat, swollen glands, fever/chills and myalgia. A list of the 66 attendees was obtained and 58 persons were interviewed. Of the 58 interviewed, 33 (57%) reportedly had become ill. All of the ill persons complained of sore throat, 27 (82%) had swollen glands, and 17 (52%) had fever.

Illness onset varied between 18 to 104 hours after the event

(mean 41.5 hours, median 37 hours). A probable secondary case was identified in the household of one of the victims. Sixteen of the victims consulted a physician and seven throat cultures were eventually taken. All but one (from a person who had already started taking antibiotics) were later reported as positive for beta hemolytic strep infection. One of the party attendees who was taking penicillin during the event for an unrelated illness did not become ill.

Food histories and a food preparation review failed to clearly implicate a specific food. Several foods, including a cold chicken salad and several types of homemade cookies, were subject to much hand contact and may have been vehicles of infection. Significantly, several of the country club workers had streptococcal pharyngitis diagnosed in the week or two previous to the event. Clearly the organism had been present at the country club though all diagnosed workers were taking antibiotics and others claimed to be well at the time of the event. Throat cultures were normal.

In conclusion, an outbreak of streptococcal pharyngitis occurred among the persons who attended a bridal shower at this facility on May 18, 1986. The source of the infection and vehicle of transmission were not positively identified. Transmission through food or by person-to-person contact were both examined. The high attack rate (57%) and clustering of cases (onsets closely time associated) supports a foodborne hypothesis, possibly transmitted through multiple vehicles.

### Editor's Note

Foodborne streptococcal disease has rarely been reported to the CDC, Atlanta, Georgia in recent years. Data from annual summaries published by CDC show only three reported outbreaks nationwide from 1978 to 1982 (the most recently published report). Prior to routine milk pasteurization, milkborne outbreaks of beta hemolytic streptococcal disease were quite common.

The infectious agent, *Streptococcus pyogenes*, of serogroup A is referred to as Group A streptococci or beta hemolytic streptococci and includes approximately 75 serologically distinct types which vary greatly in geographic and time distributions. Group A streptococci producing skin infections are usually of different serological types from those associated with throat infections.

Symptoms associated with foodborne streptococcal infections are fever, sore throat, exudative tonsillitis or pharyngitis and tender cervical lymph nodes. Incubation period is commonly 1 to 3 days, rarely longer. The reservoir is man. Unfortunately, the period of communicability in untreated cases is 10-21 days. It can be much longer in cases with purulent discharges, approaching months. With adequate penicillin therapy, transmissibility generally is terminated within 24-48 hours.

Food involved in explosive outbreaks of streptococcal sore throat in recent years have been milk products, egg salad, conch salad and deviled hard-boiled eggs.

- Food Protection Bulletin, - N.Y.  
State Dept. of Health  
Vol. 2, No. 7

# Characteristics of Major Foodborne Diseases

by Robert E. Harrington  
Assistant Director of  
Technical Services and  
Safety for the National  
Restaurant Association

Reprinted with permission from the National Restaurant Association magazine *Restaurants USA* (formerly *NRA News*). This is Part III of a four-part series.

Many health departments are preparing to implement a new concept in restaurant inspection that emphasizes time/temperature control of potentially hazardous foods throughout the preparation cycle. This series introduces a streamlined version of that program called SAFE (Sanitary Assessment of Food Environment). SAFE can protect your business against an outbreak of foodborne disease by helping you identify, control and monitor the critical points in your food handling and preparation system.

In the first two parts of this series we discussed how the SAFE program establishes critical control points to prevent contamination and limit bacterial growth.

In this article we will examine the unique characteristics of the disease organisms you will be controlling: where they come from, how they grow and which ones form heat-resistant spores or toxins. This information will help you devise effective controls for some of the more frequently reported foodborne disease agents.

## *A look at Salmonella...*

Most foodborne diseases infect the tissues of the digestive tract, resulting in gastric distress: nausea, vomiting, cramps and diarrhea. Probably the best known of the infectious intestinal organisms is *Salmonella* (especially since the 1985 Salmonella

outbreak in milk in Illinois which affected several thousand persons). *Salmonella* produces fever, vomiting, diarrhea and abdominal pain. The disease usually last several days, unless the bacteria burrow through the intestinal wall and cause more serious effects. Severe diarrhea can lead to dehydration or other secondary conditions, some of which can be fatal.

Many wild and domestic animals are naturally infected with *Salmonella*, and the bacteria are shed in feces. Insects, rodents and birds spread *Salmonella* in their droppings, therefore effective pest control must be part of your SAFE program. Poultry is frequently infected, and slaughter practices increase the level of contamination. You should regard any piece of raw poultry as a potential carrier of *Salmonella*, and anyone who handles raw poultry must thoroughly wash their hands before touching other food. Utensils and work surfaces (knives, cutting boards, counters, etc.) must be washed and sanitized after poultry use to avoid cross-contamination to their foods. *Salmonella* is also often found in other raw meats as well as on and in eggshells.

Infected human carriers may have mild illnesses or no symptoms at all and still shed *Salmonella* in their stools. That is why personal hygiene is such an important control for this organism. Obviously, an employee with diarrhea should not be allowed to handle foods or clean utensils, and you may wish to request medical clearance before an ill employee returns to work.

*Salmonella* is susceptible to temperature control. Rapid chilling to 45°F or less and hot storage above 140°F will inhibit growth. Cooking to 165°F in the center of foods will kill *Salmonella*. However, the dry conditions on the surface of large roasts may allow some survival, so

added moisture in the form of roasting bags, foil wrap coverings, water pans, etc. will improve the kill rate.

## *Other infectious intestinal organisms...*

*Shigella* is an intestinal organism similar to *Salmonella* but its source is infected workers. Control is based on good personal hygiene, keeping ill workers off the job, quickly refrigerating foods below 45°F, heating foods to 165°F and holding hot food above 140°F.

*Camphylobacter* is a common contaminant of raw meats and poultry. Control points must stress personal hygiene, through cooking and rapid chilling to prevent multiplication.

*Vibrio parahaemolyticus* is a contaminant of fish and shellfish, including shrimp and crab. Good refrigeration and thorough cooking are necessary for control of *Vibrio*. Raw or undercooked seafood may also transmit worms or other parasites. Reputable sources, careful inspection of shipments, freezing and thorough cooking are the most effective control points.

*Staphylococcus (staph)* produces a toxin which causes violent, explosive vomiting and sometimes diarrhea one to six hours after it is ingested. Because the illness is caused by a toxin, not infection, there usually is no fever. Although the symptoms only last for a day or two, they are so severe that exhaustion and dehydration can produce serious after-effects. Staph is sometimes found in bruised poultry, but its primary sources is the nose and throat discharge of humans, along with infected cuts, burns and boils. Thus, good personal hygiene is the first line of defense against Staph contamination. Workers with infected cuts or burns should be excluded from food handling as should those with viruses and colds, as coughing and sneezing spread Staph. Frequent and thorough handwashing will re-

duce the numbers of *Staphylococcus* that get into foods.

Staph is a poor competitor, and may not grow well if other organisms are present. If a cooked food is recontaminated by *Staphylococcus*, the bacteria grow explosively when the food cools slowly between 140°F and 45°F. Staph also grows well in foods with high concentrations of salt or sugar, such as ham and custards, so these foods need careful refrigeration.

However, the bacteria produce a heat-stable toxin which is not destroyed by cooking temperatures. So you cannot count on heating alone to protect against Staph. Your controls must include prevention of contamination through good hygiene and rapid cooling to 45°F to prevent growth. *Staphylococcus* is often implicated in cases where large quantities of food, such as chili, are allowed to cool slowly in large masses for several hours. During this slow cooling, the Staph toxin is formed, and it cannot be inactivated by even the most vigorous reheating.

Chilling foods rapidly in small, shallow pans cuts the exposure time by more than 75 percent and deprives Staph or other bacteria of the time they need for growth.

#### ***Botulism can be fatal...***

*Botulism* is another foodborne disease caused by a toxin. *Clostridium botulinum*, the causative organism, is commonly found in soil or dirt, and raw vegetables are often contaminated. This microbe forms tough spores which are not destroyed by normal cooking temperatures; and when these spores germinate at favorable temperatures, they produce the toxin. The nervous system is poisoned, resulting in dizziness, double vision and paralysis. Botulism can be fatal.

Luckily the bacteria do not grow rapidly in acid foods (below pH 4.6) or at refrigerator temperatures below 45°F. In addition to these limits, the microbes can only grow in the absence of the free oxygen. In the past, Botulism was associated with vacuum-sealed canned goods, especially

non-acid home canned products. But recent outbreaks have been linked to potato salad and sauteed onions; spores survived the initial cooking, then slow cooling in large masses allowed incubation under anaerobic (no oxygen) conditions.

Control of Botulism involves using only commercially canned products, holding cooked foods above 140°F and rapidly cooling to less than 45°F in shallow containers, preferably less than four inches deep.

*C. Perfringens* is another anaerobic spore-former. It causes lower intestinal distress, with pain, cramps, gas and diarrhea. Raw meats are often contaminated so it is important to prevent cross-contamination from raw to cooked foods. Most outbreaks are associated with meats, stews, sauces, gravies, etc., which are cooled slowly in large masses or inadequately reheated. There are several critical control points, including holding hot foods hot (above 140°F) to prevent growth. Chill foods rapidly to below 45°F to limit growth and reheat rapidly to 165° to destroy the bacteria.

#### ***Rapid reheating does not mean slow warming...***

Rapid reheating does not mean slow warming in a steamtable or bain-marie. These appliances are designed to hold foods which are already hot. Using them to heat a cold product may prevent scorching, but it also encourages bacterial growth. To raise food temperature quickly, use range tops, conventional or microwave ovens and limit the time in the danger zone between 45°F and 140°F.

*Bacillus cereus* is found in soil and dust. It causes nausea, cramps and diarrhea. It grows well in custards, puddings, sauces and cooked grains, especially rice. As with many other disease bacteria, control rests mainly on rapid chilling in small quantities.

*Scombrotoxin poisoning* is associated with dark meat fish, such as tuna and mackerel. When fish are not refrigerated, *Proteus* bacteria can form waste products, which cause intense headaches, dizziness, nausea,

vomiting, facial swelling and itching. The toxic material is not destroyed by cooking. It survives boiling for more than an hour, so control must be through conscientious refrigeration of fish—from the time of the catch to the use in the kitchen.

Many other seafoods also can cause illness from a variety of naturally occurring toxins or biological contaminants. Your best control is to buy only from approved, reputable sources, inspect the shipment closely before accepting delivery and retain shipping tags as proof of the source. Reject any shipment that shows signs of temperature abuse. The flesh should be firm, the gills should be bright red, the eyes should be firm and protruding and there should be no offensive odors. The maxim, "the nose knows..." remains a legitimate yardstick for freshness.

*Fungi* are primarily spoilage—rather than pathogenic—organisms. The most familiar fungi are the white molds on some cheeses or the blue-grey-green "fuzz" on fruits. Molds grow best in moist conditions, such as in refrigerators or wet grains, but they are capable of growing on virtually any food, hot or cold, salty or sugared, acid or alkaline.

A few of the molds are beneficial, such as those which produce Roquefort or blue cheese; but by the time most molds become visible, they have literally spoiled the food. Molds' digestive products impart "musty" flavors, and some molds produce toxic or cancer-causing substances. FDA has approved trimming moldy cheese under very limited circumstances. But for safety's sake and to avoid flavor and quality losses, you should examine your inventory-rotation and shelf-life policies and should rotate stocks quickly enough to prevent mold growth.

Other mold control is based on cleanliness and good housekeeping.

Keep work and storage areas clean and reduce the numbers of mold spores in the air. Since many species of mushrooms contain deadly poisons, you should use only commercially grown mushrooms from a commercial supplier.

*Yeasts* can also be beneficial, as in fermenting alcoholic beverages and in leavening doughs but, like molds, they are most often spoilage organisms. They can usually be recognized by gas bubbles, and the smell or flavor of alcohol in the food. Discard any food so affected. Cleanliness, housekeeping and inventory control, especially rotation, are again your best controls.

***In sum...***

There are literally hundreds (perhaps thousands) of species of bacteria, viruses, molds and chemical poisons that can turn a delicious meal into a vehicle for disease. Although each organism has its own unique niche in life, with special growth characteristics, your critical control points can prevent microbial growth. Careful, critical emphasis on the three broad areas of SAFE food handling is the most reliable way to prevent foodborne disease. To reiterate,

- **keep it clean** - prevent contamination by separating raw and cooked products, insisting on good habits of personal hygiene and using clean, sanitized utensils in your operation.
- **keep it hot** - heat potentially hazardous foods rapidly, cook thoroughly, hold above 140°F and reheat to 165°F.
- **keep it cold** - chill foods rapidly in small shallow containers to 45°F or less.

*Next issue: Applying the principles of SAFE.*



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## Report of Spring Meeting, April 1, 1987

### Ohio Association of Milk, Food and Environmental Sanitarians Duff's Smorgasbord Columbus, Ohio

Although this was our Spring meeting, evidence of winter was still plentiful. On March 31, Ohio had a record snowfall with many areas of the State receiving more than 10 inches. The weather may have influenced attendance but there were still 75 present. The program was of current interest with exceptionally well qualified speakers. The attendees asked numerous questions and participated in the overall discussions. The program truly met the criteria - to increase technical expertise. The efforts of the Affiliate's Officers was quite evident throughout the meeting.

Membership in IAMFES was highlighted along with encouraging attendance at the Annual Meeting in Anaheim, California. Members were asked to nominate deserving individuals for consideration for IAMFES Awards. A request was made for door prizes at the Annual Meeting. A comment was made regarding the availability of the 4th edition of "Procedures to Investigate Foodborne Illness."

## Book Reviewers Wanted!

Free books to members who read and write book reviews for Dairy and Food Sanitation. For an updated list of books write:  
Associate Editor, Dairy and Food Sanitation, P.O. Box 701, Ames, IA 50010.

## Affiliate Calendar

1987

**August 2-7, CALIFORNIA ASSOCIATION OF DAIRY AND MILK SANITARIANS BUSINESS MEETING**, to be held at the Disneyland Hotel in Anaheim, CA. For more information contact: Richard Harrell at 213-757-9719 or Austin Olinger at 818-968-9621.

**September 15-16, 1987 ANNUAL CONVENTION OF THE SOUTH DAKOTA STATE DAIRY ASSOCIATION**, to be held at Howard Johnson's, Sioux Falls, SD. For more information contact: Shirley W. Seas, South Dakota State Dairy Association, University Dairy Building, Brookings, SD 57007. 605-688-5420.

**September 17-18, MINNESOTA SANITARIANS ASSOCIATION ANNUAL MEETING**, to be held at the Earle Brown Center, Univ. of Minnesota, St. Paul Campus. For more information contact: Roy E. Ginn, Dairy Quality Control Inst., 2353 N. Rice St., Room 110, St. Paul, MN 55113. 612-484-7269.

**September 21-23, NEW YORK STATE ASSOCIATION OF MILK & FOOD SANITARIANS ANNUAL MEETING**, to be held at the Sheraton Inn Syracuse, (Liverpool, NY). For more information contact: Paul J. Dersam, 27 Sullivan Rd., Alden NY 14004. 716-937-3432.

**September 30-October 2, KANSAS ASSOCIATION OF SANITARIANS ANNUAL MEETING**, to be held at the Holidome in Lawrence, Kansas. For more information contact: John M. Davis. 316-268-8351.

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Abstracts of papers in the June Journal of Food Protection

To receive the Journal of Food Protection in its entirety each month call 1-800-525-5223, ext. A or 515-232-6699, ext. A in Iowa.

**Growth of *Listeria monocytogenes* in Skim, Whole and Chocolate Milk, and in Whipping Cream during Incubation at 4, 8, 13, 21 and 35°C,** Eileen M. Rosenow and Elmer H. Marth, Department of Food Science and The Food Research Institute, University of Wisconsin-Madison, Madison, Wisconsin 53706

*J. Food Prot.* 50:452-459

Autoclaved samples of skim, whole, and chocolate milk and of whipping cream were inoculated with *Listeria monocytogenes* (one to four strains were tested individually, depending on the experiment) and incubated at 4, 8, 13, 21 or 35°C. Growth curves were then derived and generation times and maximum populations calculated for each combination of strain, product, and temperature. The growth rate of *L. monocytogenes* was similar in all four products at a given incubation temperature and increased with an increase in temperature. Doubling times over all products and strains were 41 min (35°C), 1 h 43 min-1 h 55 min (21°C), 4 h 27 min-6 h 55 min (13°C), 8 h 40 min-14 h 33 min (8°C), and 29 h 44 min-45 h 33 min (4°C). In each instance, maximum populations reached were at least  $10^7$  cells/ml, with highest numbers consistently produced in chocolate milk (at least 10 times greater than in skim or whole milk or cream at any temperature). Little decrease in final numbers occurred with extended storage at the incubation temperature being studied. All results were analyzed statistically to determine magnitude and source of variation. Observed differences in data resulted from interactive effects between strain, product, and temperature. Therefore, no single factor can be considered as the sole cause of a particular finding. That *L. monocytogenes* can attain such high populations at low temperatures should be of concern. Since refrigerated storage is no guarantee of protection against growth of *L. monocytogenes*, every precaution should be taken to prevent contamination of certain foods by this organism.

**Changes in the Microbial Quality of *Nephrops norvegicus* during Processing for Retail Packs,** R. H. Madden and S. Kinghan, Agricultural and Food Bacteriology Research Division, Department of Agriculture for Northern Ireland, Newforge Lane, Belfast BT9 5PX, and Food Technology Division, Department of Agriculture for Northern Ireland, Loughry College, Cookstown, County Tyrone, United Kingdom

*J. Food Prot.* 50:460-463

The microbial quality of whole tails of prawns, *Nephrops norvegicus*, caught in the Irish Sea, was determined after freezing. The effects of subsequent processing into frozen prawns and breaded and battered scampi, in retail packs, were then monitored. The mean TVC of the whole tails was  $1.3 \times 10^6$ /g whilst that of the processed tails was  $9.7 \times 10^5$ /g. Peeling and polyphosphate treatment caused a significant reduction in the total count of bacteria whilst gutting/sorting and reforming caused increases. Overall, processing caused an insignificant change in the TVC, when compared with the initial load. The ratio of coliforms: total count of bacteria increased steadily dur-

ing processing and might serve as an indicator of the source of contamination with poor quality final product. Low-grade raw materials would have a low ratio and poor hygiene in processing but good quality raw materials would result in a high ratio. Both TVC and coliform counts are required to determine microbial quality.

**Determination of Rosin Ester Gum Emulsifiers in Fruit Juices by Gas Chromatography,** Yasuhide Tonogai, Thoru Ando, Akihiro Tsumura and Yoshio Ito, National Institute of Hygienic Sciences, Osaka Branch, Hoenzaka, Higashi-ku, Osaka, Japan; Osaka Airport Quarantine Station, Hotarugaike nishimachi, Toyonaka, Japan; and Kobe Agricultural and Forestry Products Inspection Institute, Onohama-cho, Chuo-ku, Kobe, Japan

*J. Food Prot.* 50:464-467

A method for detection and determination of rosin ester gum in fruit juice was established as follows. Rosin ester as a component of ester gum was extracted with benzene from the sample, and saponified with *N*/2 KOH-ethanol solution. The rosin acids were extracted with diethyl ether in acidic condition, derivatized with TMS reagent and determined by gas chromatography (GC). Seven kinds of ester gum standard were analyzed by the proposed method, and it was found that contents of dihydroabietic acid and abietic acid in the ester gums ranged between 33.8-75.1% and 0-36.7%, respectively, but the total contents of them were 66.7-75.1% (average,  $70.9 \pm 3.0\%$ ). Dihydroabietic acid and abietic acid derived from ester gum in 6 kinds of imported fruit juice were identified by GC-mass spectra and quantitated by GC. The contents of ester gum in samples estimated from the two peaks were 15.2-33.9 ppm. Recoveries of ester gum added to sample at 50 and 500 ppm were more than 92.7%, and the detection limit of ester gum was  $0.5 \mu\text{g}$  (2 ppm in sample) by the proposed method.

**Detection, Isolation and Identification of Osmotolerant Yeasts from High-Sugar Products,** Marco F. G. Jermini, Otto Geiges and Wilhelm Schmidt-Lorenz, Food Microbiology Laboratory, Department of Food Science, Swiss Federal Institute of Technology (ETH), CH-8092 Zürich, Switzerland

*J. Food Prot.* 50:468-472

A simple presence-absence test for detection of small numbers of osmotolerant yeasts in foods was developed. Yeast extract glucose 50 broth [consisting of 0.5% (w/w) yeast extract and 50% (w/w) glucose] was used as enrichment medium and was incubated with agitation at 30°C. The detection was done by (a) microscope and (b) streaking 0.03 ml of enrichment culture on selective yeast extract glucose 50 agar and incubation at 30°C for 5-7 d. If no yeast cells were observed under the microscope within 10 d of incubation, the product sample was judged as "free from osmotolerant yeasts." In accordance with this method 28 strains of osmotolerant yeasts were isolated from 27 spoiled high-sugar products. Twenty-four strains were identified as *Zygosaccharomyces rouxii*, 2 as *Zygosaccharomyces bailii* and 1 each as *Torulasporea delbrueckii* and *Debaryomyces hansenii*.

**Cardinal Temperatures for Growth of Osmotolerant Yeasts in Broths at Different Water Activity Values,** Marco F. G. Jermini and Wilhelm Schmidt-Lorenz, Food Microbiology Laboratory, Department of Food Science, Swiss Federal Institute of Technology (ETH), CH-8092 Zürich, Switzerland

*J. Food Prot.* 50:473-478

All three cardinal temperatures ( $T_{min}$ ,  $T_{opt}$  and  $T_{max}$ ) for growth of 6 strains as well as  $T_{min}$  and  $T_{max}$  for growth of an additional 23 strains were determined in solutions of 10, 30, 50 and 60% (w/w) glucose at  $a_w$  (20°C) of 0.990, 0.970, 0.922 and 0.868, respectively. The  $T_{opt}$  for growth of *Zygosaccharomyces rouxii* and *Z. bisporus* were 24-28.5°C at  $a_w > 0.990$  and 31-33°C at  $a_w$  in the range of 0.922-0.868. *Z. bailii* showed  $T_{opt}$  for growth of 29-31°C and 33-35°C at  $a_w > 0.990$  and  $a_w < 0.922$ , respectively. The  $T_{opt}$  for growth of *Torulasporea delbrueckii* was 27-28.5°C at  $a_w < 0.990$  and 31-33.5 at  $a_w$  in the range of 0.922-0.868. *Debaryomyces hansenii* showed a  $T_{opt}$  of 24°C and 27-29.5°C at  $a_w > 0.990$  and  $a_w < 0.922$ , respectively. The  $T_{min}$  and  $T_{max}$  for growth were also shifted toward higher values as the  $a_w$  decreased; at  $a_w < 0.922$  none of the tested strains grew at 4°C within 30 d. Several strains could grow at 42°C only in the presence of high sugar concentrations.

**Monoclonal Antibodies Directed Against the Flagellar Antigens of *Listeria* Species and Their Potential in EIA-Based Methods**, Jeffrey M. Farber and Joan I. Speirs, Bureau of Microbial Hazards, Food Directorate, Health Protection Branch, Health and Welfare Canada, Tunney's Pasture, Ottawa, Ontario, Canada K1A 0L2

*J. Food Prot.* 50:479-484

Monoclonal antibodies directed against antigens of *Listeria* spp. were produced. Three main classes of immunoglobulins were found that reacted with *Listeria* strains containing either the A, B, or C flagellar antigen. These antibodies reacted with *Listeria monocytogenes*, *Listeria welshimeri*, *Listeria seeligeri*, *Listeria ivanovii* and *Listeria innocuus*, but not *Listeria grayi*, *Listeria murrayi* or *Listeria denitrificans*. The monoclones tested did not cross-react with any of the 30 non-*Listeria* cultures examined, including *Staphylococcus aureus* and *Streptococcus faecalis*. Cheese and milk samples naturally-contaminated with *L. monocytogenes* were found to be positive for *Listeria* within two working days after initiation by using the monoclonal antibodies in an enzyme immunoassay.

**Indole-Induced, Green to Brown-Black Pigment Formation by an *Acinetobacter* Strain from Beef**, C. Vanderzant, J. W. Savell, P. L. Hamby, G. R. Acuff, N. A. Cox and J. S. Bailey, Department of Animal Science, Texas Agricultural Experiment Station, Texas A & M University, College Station, Texas 77843 and Agricultural Research Service, Richard B. Russell Agricultural Research Center, Athens, Georgia 30613

*J. Food Prot.* 50:485-486

In determining aerobic plate counts of surfaces of beef carcasses, green to brown-black colonies of an *Acinetobacter* sp. appeared on tryptic soy agar plates. Pigmentation was induced by indole-producing organisms in close proximity of or overlapping with the *Acinetobacter* sp. Addition of indole to culture media also supported pigmentation of the *Acinetobacter* sp. Indole appeared to be a key intermediate compound in pigment formation.

**Increased Reliability in Detection of Enterotoxigenic *Escherichia coli* by DNA Colony Hybridization**, Valerie Mitchell Davis, Food and Drug Administration, San Francisco, California

*J. Food Prot.* 50:487-489

Previously a DNA hybridization assay was designed to detect the presence of and to enumerate enterotoxigenic foodborne *Escherichia coli*. The determinative step in the method involves autoradiographic analysis of the DNA from foodborne isolates after hybridization with a  $^{32}P$ -labeled probe specific for an enterotoxin gene. Dark spots appearing on the X-ray film after exposure indicate which colonies carry genes encoding the pathogenic determinant. A problem with this assay is the tendency of some colonies to detach from the nitrocellulose filters during hybridization or washing to remove the unbound probe DNA; this results in a false-negative interpretation in up to 60% of the samples processed at 80°C. By lowering the temperature to 70°C and increasing the incubation time to 3 h during in vacuo baking of filters, detachment (flotation) of colonies is reduced to about 37%. At 65°C only 2% of the colonies came off the filter after in vacuo baking of filters for 24 h. Another problem has been the inadequacy of exposure of X-ray film at -20°C when a -70°C freezer is not available. This problem can be alleviated by exposing the X-ray film in cassette holders "sandwiched" between slabs of dry ice (CO<sub>2</sub> ice has a temperature of -78.5°C). These modifications improve the reliability and accuracy of this DNA colony hybridization method.

**Iodine Content of Dairy Milk in France in 1983 and 1984**, G. Aumont, F. Le Querrec, M. Lamand, and J. C. Tressol, I. N. R. A., Laboratoire des Maladies Nutritionnelles, C. R. Z. V. de Theix, 63122 Ceyrat, France and Direction de la Qualité, Service Vétérinaire d'Hygiène Alimentaire, 174, rue du Chevaleret, 75646 Paris Cedex 13, France

*J. Food Prot.* 50:490-493

Iodine concentrations were determined in 848 samples of milk from tanks of 537 dairy factories collected in 1983 and 1984 during winter and summer. Industrial processing, like pasteurization, UHT sterilization and spray-drying, had no effect on iodine concentrations. Of the samples of bovine milk, 94.7% ranged between 10 to 250 µg/kg. Iodine in bovine milk averaged 97 and 93 µg/kg in the winter of 1983 and 1984, and 44 and 23 µg/kg in the summer of 1983 and 1984. The frequency of iodine concentrations above the 500 µg/kg limit was 0.5% in 1983 and 0.3% in 1984. Iodine in ovine milk varied from 116 to 1183 µg/kg. Of the ovine milk samples 53.3% were above 500 µg/kg. Thus the iodine content of milk, is not yet a health problem in France.

**Thermal Inactivation of *Salmonella* Species in Fluid Milk**, J.-Y. D'Aoust, D. B. Emmons, R. McKellar, G. E. Timbers, E. C. D. Todd, A. M. Sewell and D. W. Warburton, Bureau of Microbial Hazards, Health Protection Branch, Health and Welfare Canada, Sir Frederick, G. Banting Research Centre, Tunney's Pasture, Ottawa, Ontario, Canada K1A 0L2 and Food Research Centre and Engineering and Statistical Research Centre, Research Branch, Agriculture Canada, Ottawa, Ontario, Canada K1A 0C6

*J. Food Prot.* 50:494-501

The thermal resistance of *Salmonella senftenberg* 775W, *Salmonella muenster* previously isolated from raw fluid milk, and two mixtures each consisting of ten *Salmonella* strains commonly isolated from human or non-human sources was tested. Cells were suspended in whole milk at a final concentration of 10<sup>5</sup> cells/ml. The inoculated milk was thermally processed at temperatures ranging from 60°C to 74°C using a pilot-scale plate pasteurizer unit. The mean and minimum residence time of milk in the holding tube of the pasteurizer was 17.6 and

16.2 s, respectively. The maximum temperature at which viable salmonellae were detected in the human (61.5°C) and non-human (64.5°C) mixtures was considerably lower than that obtained with *S. senftenberg* 775 W (67.5°C). *S. muenster* failed to show any milk-adapted response and could not be recovered at temperatures greater than 63.0°C. Treatment at 63°C produced a 4 log<sub>10</sub> or greater reduction in the number of viable *Salmonella* including the heat resistant *S. senftenberg* 775 W, and a minimum 2 log<sub>10</sub> decrease at 60°C. These findings warrant caution in the use of subpasteurizing temperatures for thermal processing of fluid milk.

**ELISA Survey of Retail Grain-Based Food Products for Zearalenone and Aflatoxin B<sub>1</sub>**, Roscoe L. Warner and James J. Pestka, Department of Food Science and Human Nutrition, Michigan State University, East Lansing, Michigan 48824

*J. Food Prot.* 50:502-503

Seventy-nine grain-based food products were purchased from mid-Michigan retail grocery outlets in 1985 and analyzed for the mycotoxins zearalenone and aflatoxin B<sub>1</sub> by enzyme-linked immunosorbent assay. Twenty-two percent of these samples contained detectable zearalenone (limit  $\geq 2.5$   $\mu\text{g}/\text{kg}$ ). Zearalenone was found in breakfast cereal, snack foods, popcorn, corn meal, and cake-muffin mixes representing 10, 11, 57, 78, and 20% of these samples, respectively. The average level of this toxin among the positive samples was 20  $\mu\text{g}/\text{kg}$  with maximum levels of 120 and 130  $\mu\text{g}/\text{kg}$  being found in samples of corn meal and popcorn, respectively. Zearalenone was not found in any of the wheat flour or baby foods samples. Detectable aflatoxin B<sub>1</sub> (limit  $\geq 5.0$   $\mu\text{g}/\text{kg}$ ) was not found in any of the 79 samples tested.

**Destruction of Aflatoxins on Peanuts by Oven- and Microwave-Roasting**, H. R. Pluyer, E. M. Ahmed and C. I. Wei, Food Science and Human Nutrition Department, University of Florida, Gainesville, Florida 32611

*J. Food Prot.* 50:504-508

Effects of oven and microwave roasting on aflatoxin-contaminated peanuts were studied. In artificially contaminated peanuts, oven-roasting for 30 min at 150°C or microwave-roasting for 8.5 min at 0.7 kW were equally effective in destroying 30 to 45% of AFB<sub>1</sub>. Analysis was performed by the Best Food method followed by thin-layer chromatography and densitometry. In naturally contaminated peanuts, both oven- and microwave-roasting were equally effective in destroying 48 to 61% of AFB<sub>1</sub> and 32 to 40% of aflatoxin G<sub>1</sub> (AFG<sub>1</sub>).

**Incidence and Toxicogenicity of *Aeromonas* Species in Retail Poultry, Beef and Pork**, Anita J.G. Okrend, Bonnie E. Rose and Barbara Bennett, Food Safety and Inspection Service, U.S. Department of Agriculture, Building 322, ARC-East, Beltsville, Maryland 20705

*J. Food Prot.* 50:509-513

Five enrichment broths and five selective and differential plating media were tested for efficiency of isolation of *Aeromonas* spp. from chicken, beef and pork. An overnight incubation of sample in Trypticase soy broth containing 10  $\mu\text{g}$  of ampicillin/ml which was spread on starch ampicillin agar or on MacConkey mannitol ampicillin agar, gave the best results. A small survey was conducted on 10 samples each of chicken thigh-meat, ground beef, and pork sausage or ground unseasoned pork purchased from local food stores. *Aeromonads* were

found in all of the samples in numbers ranging from  $4.44 \times 10^2$  to  $4.44 \times 10^3/\text{g}$  except for two of the pork products from which the organisms could not be isolated. Fifty-eight isolates from this survey were tested for hemolysin production and cytotoxin production; 36 isolates were tested for production of cholera-like toxin. Cytotoxin, as detected by mouse adrenyl Y1 cells and Chinese hamster ovary cells, was produced by 92.8% of the *Aeromonas hydrophila* isolates, by 84.6% of the *Aeromonas sobria* isolates and by 17.6% of the *Aeromonas caviae* isolates. Hemolysin production paralleled cytotoxin production in *A. hydrophila* and *A. caviae*. Of the *A. sobria* isolates, 69.2% were hemolysin producers. None of the isolates tested produced cholera-like toxin. It is not known whether the presence of cytotoxin- and hemolysin-producing *Aeromonas* species in retail meat and poultry has any public health significance, since to date there have been no reported outbreaks of *Aeromonas*-caused gastroenteritis traced to meat or poultry.

**Influence of Prolonged Culture Storage on the Osmotolerance of *Zygosaccharomyces* Yeasts**, Marco F. G. Jermini, Karl Weber and Wilhem. Schmidt-Lorenz, Food Microbiology Laboratory, Department of Food Science and Department of Mathematics, Swiss Federal Institute of Technology (ETH), CH-8092 Zürich, Switzerland

*J. Food Prot.* 50:514-520

To record the effects of prolonged culture storage on the sugar tolerance of *Zygosaccharomyces rouxii* and *Z. bailii*, the fermentation behavior of three freshly isolated strains in four different glucose broths ( $a_w$  values; 0.963, 0.936, 0.909 and 0.858, respectively) was compared with that of the same strains after 2 years of storage (a) on high-sugar agar slants with repeated subculturing and (b) in Biomalt (liquid malt extract) without subculturing. The trials with stock strains resulted in large reductions of both ethanol yield and production rate. Cells stored in liquid malt extract showed a slightly faster and stronger fermentation than cells maintained on agar slants. Therefore, for storage of osmotolerant culture collections use of natural liquid products such as Biomalt, without subculturing, is suggested.

**Determining the Safety of Maltogenic Amylase Produced by rDNA Technology**, Jarl R. Andersen, Børge K. Diderichsen, Rolf K. Hjortkjaer, Anne S. De Boer, James Bootman, Heather West and Roger Ashby, Product Approval Department of Research and Development Division, Novo Industri A/S, 2880 Bagsvaerd, Denmark and Life Science Research, Eye, Suffolk IP23 7PX, England

*J. Food Prot.* 50:521-526

A maltogenic amylase produced by a genetically engineered *Bacillus subtilis* was studied to evaluate its safety in the food industry. First, the safety of the component parts used in the cloning process, i.e. the host organism (*B. subtilis*), the donor organism (*Bacillus stearothermophilus*) and the construction process, were evaluated. This evaluation indicated that the final construct should be regarded as a safe source for maltogenic amylase when manufactured according to current Good Manufacturing Practices. Additional experimental safety testing was carried out to confirm this conclusion. In a 13-week oral toxicity study rats tolerated the maltogenic amylase at dietary levels of 5% without toxicologically significant adverse reaction. Lack of mutagenic potential was confirmed in bacterial mutagenic assays with *Salmonella typhimurium* and in an in vivo cytogenetic

study in rat bone marrow cells. In an acute inhalation study with 4 h of exposure to rats, no death occurred at the highest dose level, i.e., 1.59 mg/L. The test material was non-irritating to skin and did not produce eye injury in rabbits. A skin sensitization study in guinea pigs was negative. Antibiotic activity tests indicated that the microorganism did not produce antibiotics. Results indicated that maltogenic amylase should be generally recognized as safe for use in production of maltose syrups, and confirmed the conclusion drawn from the safety evaluation of the component parts used in the cloning process.

**Factors Important in Determining the Heat Process Value  $F_T$ , for Low-Acid Canned Foods,** I. J. Pflug, Department of Food Science and Nutrition, University of Minnesota, 1334 Eckles Avenue, St. Paul, Minnesota 55108

*J. Food Prot.* 50:528-533

In this monograph an attempt is made to put into perspective several factors that impinge on the heat process value,  $F_T$ . In the heat processing of low-acid canned foods (LACF), there are three specific types of final product spoilage that concern the food microbiologist and the food manufacturer. These three areas are discussed in some detail. The order to follow in the design of LACF and endpoint values are suggested. Use of descriptive and numerical terms for the endpoint of the LACF heat preservation process is discussed. The origin of the term, "commercial sterility," is reviewed; reasons for replacing this term (in the future) with a specification are presented. The several faces of the widely-used heat process value,  $F_T$ , are examined. The use of a safety factor to take care of unknown processing conditions is proposed. Suggested safety factors are listed. The classical research of Esty and Meyer on resistance of *Clostridium botulinum* is reviewed and interpreted using the simple logarithmic model. The often-quoted but poorly-understood term, 12D, is discussed.

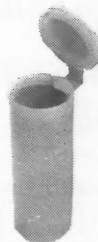
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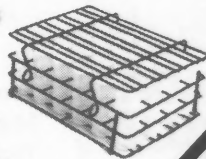
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**The Microbiology of Slow-cooked, Stuffed Turkey, K.-F. Eckner\*, E. A. Zottola and R. B. Gravani**, University of Minnesota; Department of Food Science and Nutrition; 1334 Eckles Avenue; St. Paul, Minnesota; 55108.

Recently a recipe for stuffing and slow-cooking a turkey overnight appeared in a national magazine. Questions arose concerning the microbiological safety of the recipe and the cooking times stated. The stuffing was prepared according to the recipe and then inoculated with *Staphylococcus aureus*, *Salmonella typhimurium* and *Clostridium perfringens* at  $10^5$  organisms per ml. Four turkeys were prepared for cooking and were stuffed. Thermocouples were inserted into various parts of the turkey and the stuffing to record the temperatures attained during roasting. The turkeys were roasted until the center of the stuffing reached 165°F. After cooking, the stuffing was aseptically removed, incubated in 12 liters of 0.1% peptone broth and plated onto appropriate diagnostic media. No salmonella or staphylococci were isolated from the stuffing, but *Clostridium perfringens* was present after roasting. The results indicated that pathogenic bacteria could survive if the published procedure for minimum prescribed cooking time was used.

**Assessment of the Microbial Quality of Dairy Powder Using the Impedance Technique, N. Tsang\*, R. Firtenberg-Eden, M. Lamb, BACTOMATIC, INC., P.O. Box 3103, Princeton, New Jersey 08540.**

An array of automated tests were developed to rapidly determine dairy powder quality. Using an impedance method for enumerating total count, 10 g of the sample were dissolved in 90 ml of a Detection Medium (DM) and preincubated at 35°C for 4 hours. One ml of this sample was then loaded into a well in the test module that was pre-filled with 1 ml of DM. The change in the capacitance signal was monitored (24 h, 35°C). Regression analysis showed high correlation between the impedance method and the standard plate count method. The impedance method for fecal streptococci consisted of dissolving 10 g of the sample in 90 ml of a newly formulated Fecal Streptococci Medium (FSM) and subsequently loading 1 ml of the sample into a well in the test module. The capacitance signal was monitored (24 h, 35°C). Samples with fecal streptococci levels equal to the specification limits (10-100 CFU/g) could be detected by the impedance method within 18 h. A large variety of dairy powders, including dry milk powders, were tested. The FSM effectively inhibited the growth and detection of interfering bacteria, including the *Bacillus* sp. and Group N *Streptococcus* sp. These two tests, along with other impedance methods, such as the coliform test and the *E. coli* test, provide the industry with a fast, easy and versatile approach in controlling the microbial quality of dairy powders.

**Antimicrobial Effect of Chlorine on *Listeria monocytogenes* in Phosphate Buffer and Brussels Sprouts, R. E. Brackett\***, Department of Food Science and Technology, University of Georgia, Experiment, GA 30212.

The antimicrobial effect of reagent grade sodium hypochlorite (SH) and household bleach (HB) on 2 strains of *Listeria monocytogenes* (Scott A and LCDC 81-861, both serotype 4A) was determined. After 24 h growth in tryptic soy broth, cells were centrifuged, and the pellets resuspended in potassium phosphate buffer (pH 7.0). 3-ml portions of the cell suspensions were then added to 27 ml phosphate buffer containing about

0, 5, 10, 50, 100, or 200 ppm free residual chlorine. Cells were exposed to the chlorine for 15, 60, 120 and 300 sec, at which time the chlorine was neutralized with 0.01 M sodium thiosulfate. Populations of surviving cells were determined by plating samples of the neutralized solution on tryptic soy agar and incubating the plates for 48 h at 30°C before counting. Chlorine concentrations less than 50 ppm showed no antimicrobial effect but exposure to 50 ppm or greater chlorine resulted in no viable cells being recovered. Results for both SH and HB were similar. Dipping Brussels sprouts containing about 5 log<sub>10</sub> colony forming units (CFU) *L. monocytogenes*/g into a 200 ppm chlorine solution for 10 sec reduced viable cells recovered on McBrides agar by about 2 log<sub>10</sub> CFU/g.

**Overview of Contaminants Distribution in Southern California Coastal Waters, Jack W. Anderson**, Southern California Coastal Water Research Project, 646 West Pacific Coast Highway, Long Beach, CA 90806.

The Southern California Coastal Water Research Project Authority (SCCWRP) is a public agency created in 1969 through a joint powers agreement between five local government agencies (City of Los Angeles, County Sanitation District of Los Angeles County, County Sanitation of District of Orange County, City of San Diego, Ventura Regional Sanitation District). These "sponsors" recognized a responsibility to conduct extensive scientific research into effects of municipal wastewater discharge on southern California coastal waters, and realized the necessity of participating on a broad-based regional level.

SCCWRP's main objectives are to provide information to various agencies on the effects of ocean discharge and non-point source inputs on the coastal waters and, ultimately, develop predicative models that will determine future impacts on the marine environment.

Recent projects of interest to participants of this meeting include a survey of contaminant levels in sediments of nearshore southern California analyses of local fish tissues for concentrations of priority pollutants and new approaches for monitoring coastal waters. Results of these investigations will be summarized.

**Processing Fluid Milk, Sidney E. Barnard, Edward D. Glass, Jr., and Ronald A. Matason**, The Pennsylvania State University, Food Science Department, 8 Borland laboratory, University Park, PA 16802.

This presentation is with a set of 140 slides and 30-minute cassette tape on Processing of Fluid Milk. It was prepared to train fluid milk plant employees who receive, process, package and clean equipment. Emphasis is on practical procedure which will eliminate spoilage and prevent food poisoning. Regulations, standards and processing procedures are included. The script was reviewed by fifteen persons in industry, state and federal regulatory, and educational institutions. Pictures were taken in seven processing plants by a professional photographer. Response from employees and management persons who have seen the presentation at six meetings in Pennsylvania was very good. The set of slides, cassette tape, and written script may be purchased for training your plant employees for 4100. Send a purchase order or check payable to Penn State to: Sidney E. Barnard, 8 Borland Laboratory, University Park, PA 16802. Telephone: 814-863-3915.



# Dairy and Food Sanitation Instructions for Authors

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## Nature of the Magazine

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*Dairy and Food Sanitation* is a monthly publication of the International Association of Milk, Food and Environmental Sanitarians, Inc. (IAMFES). It is targeted for persons working in industry, regulatory agencies, or teaching in milk, food and environmental protection.

The major emphases include: 1) practical articles in milk, food and environmental protection, 2) new product information, 3) news of activities and individuals in the field, 4) news of IAMFES affiliate groups and their members, 5) 3-A and E-3-A Sanitary Standards, amendments, and lists of symbol holders, 6) excerpts of articles and information from other publications of interest to the readership.

Anyone with questions about the suitability of material for publication should contact the editor.

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## Submitting Articles

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All manuscripts and letters should be submitted to the Editor, Kathy R. Hathaway, IAMFES, P.O. Box 701, Ames, Iowa 50010.

Articles are reviewed by two members of the editorial board. After review, the article is generally returned to the author for revision in accordance with reviewer's suggestions. Authors can hasten publication of their articles by revising and returning them promptly. With authors' cooperation articles are usually published within three to six months after they are received and may appear sooner.

Membership in IAMFES is not a prerequisite for acceptance of an article.

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## Types of Articles

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*Dairy and Food Sanitation* readers include persons working as sanitarians, fieldmen or quality control persons for industry, regulatory agencies, or in education. *Dairy and Food Sanitation* serves this readership by publishing a variety of papers of interest and usefulness to these persons. The following types of articles and information are acceptable for publication in *Dairy and Food Sanitation*.

### General Interest

*Dairy and Food Sanitation* regularly publishes nontechnical articles as a service to those readers who are not involved in the technical aspects of milk, food and environmental protection. These articles deal with such topics as the organization and application of a milk or food control program or quality control program, ways of solving a particular problem in the field, organization and application of an educational program, management skills, use of visual aids, and similar subjects. Often talks and presentations given at meetings of affiliate groups and other gatherings can be modified sufficiently to make them appropriate for publication. Authors planning to prepare general interest nontechnical articles are invited to correspond with the editor if they have questions about the suitability of their material.

### Book Reviews

Authors and publishers of books in the fields covered by *Dairy and Food Sanitation* are invited to submit their books to the editor. Books will then be reviewed and published in an issue of *Dairy and Food Sanitation*.

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## Preparation of Articles

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All manuscripts should be typed, double-spaced, on 8½ by 11 inch paper. Side margins should be one inch wide.

The title of the article should appear at the top of the first page. It should be as brief as possible and contain no abbreviations.

Names of authors and their professions should follow under the title. If an author has changed location since the article was completed, his new address should be given in a footnote.

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### Illustrations, Photographs, Figures

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Wherever possible, submission of photos, graphics, or drawings to illustrate the article will help the article. The nature of *Dairy and Food Sanitation* allows liberal use of such illustrations, and interesting photographs or drawings often increase the number of persons who are attracted to and read the article.

Photographs which are submitted should have sharp images, with good contrast.

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### Examples of Proper Bibliographic Citations

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#### Paper in a journal

Alderman, G. G. and E. H. Marth. 1974. Experimental production of aflatoxin in citrus juice and peel. *J. Milk Food Technol.* 37:308-313.

#### Paper in a book

Marth E. H. 1974. Fermentations. pp. 771-882. In B. H. Webb, A. H. Johnson, and J. A. Alford (eds.) *Fundamentals of dairy chemistry* (2nd ed.), AVI Publishing Co., Westport, CT.

#### Book

Fennema, O. R., W. D. Powrie, and E. H. Marth. 1973. *Low-temperature preservation of foods and living matter.* Marcel Dekker, Inc., New York. 598 p.

#### Patent

Hussong, R. V., E. H. Marth, and D. G. Vakaleris. 1964. *Manufacture of cottage cheese.* U.S. Pat. 3,117,870. Jan. 14.

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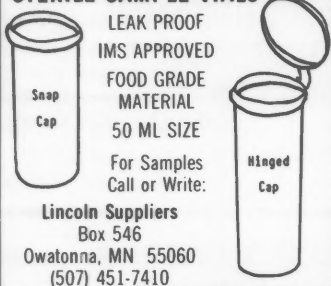
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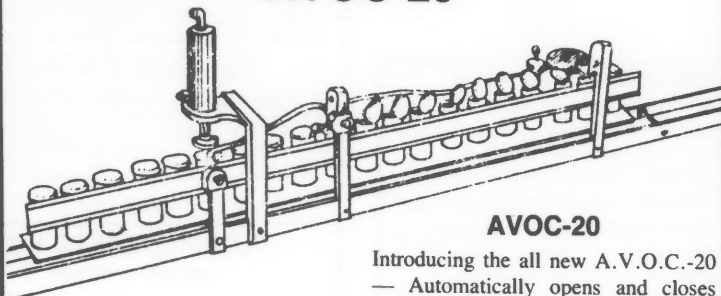
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- Milk Sanitation
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O. W. Kaufmann, Ph.D.  
Richard Gillespie, MPH.

12013 CANTRELL DR.  
CINCINNATI, OH 45246

PHONE: 513/851-1810

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## Employment Opportunities

### The Marketplace

#### -FOR DAIRY INDUSTRY PROFESSIONALS-

**Technical Services Director** ..... \$38K  
Requires 3 to 5 yrs. R&D or QA/QC exp. with drink bases or syrups. Small, but expanding company in Southern location.

**Senior Microbiologist** ..... \$30K  
Requires 2 to 4 yrs. industrial exp. with supervisory duties. Need outgoing personality to interact with customer representatives. Fortune 500 company. Northeast metropolitan area.

**Quality Control Manager** ..... \$28K  
Requires 2 to 4 yrs. exp. in dairy quality control with supervisory exp. California location.

**Laboratory Technician** ..... \$25K  
BS in Food Science with one to three yrs. exp. in quality control laboratory. Midwest location.

Many other positions available nation-wide. Call us for a confidential discussion of opportunities for food industry professionals.

Call Jeannine Burgin at 803-234-7081

**Henry-Wallace and Associates**  
30 Patewood Drive, Suite 302  
Greenville, SC 29615

READER CIRCLE NO. 308

## Employment Opportunities

### W CONSIDERING A NEW POSITION?

Now that you have decided to look for a better opportunity, contact Whittaker first!

QC/QA Supervisor .....	25-35K
IC/QC Manager .....	25-30K
Sanitarian .....	25-35K
Technical Manager .....	45K
Beverage Technologist PhD .....	50-55K
Sanitation Supervisors .....	25-29K
Director of QC .....	20-24K
Lab Techs .....	20-24K
Regional Sales Managers — Cleaners .....	30K + C + B
Regional Sales Managers — Stabilizers .....	30K + C + B
QC/R and D Manager .....	30-40K
Corporate QC Director — Multiple Plants .....	48K

#### CLIENTS NATIONWIDE

Call or Write  
Arnold Whittaker  
or  
John McCaulan

### WHITTAKER & ASSOCIATES

2675 Cumberland Pkwy., Suite 263

Atlanta, Georgia 30339, Phone: 404-434-3779

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### ATTENTION: DAIRY PROFESSIONALS

Dunhill of Southeast Fort Worth, Inc. has over 40 job openings in all areas of the dairy profession. Company paid fees, relocation and interview expenses. You may qualify. Examples:

REFRIGERATION SUPERVISORS .....	\$25-40K
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PROJECT ENGINEERS-B.S. DEGREE .....	\$30-50K
DIRECTOR Q.C. FLUID & I.C. .....	\$35-40K
REGIONAL SALES MANAGERS .....	\$30-35K
PRODUCTION SUPERVISORS .....	\$25-30K
VAULT/SHIPPING SUPERVISORS .....	\$25-32K
TRAFFIC MANAGER .....	\$30-40K
PRODUCTION NOVELTIES I.C. .....	\$25-40K
CHIEF ENGINEERS-ALL AREAS .....	\$30-45K
PLANT CONTROLLERS .....	\$28-47K

Send resume in confidence to:

Mr. Dana S. Oliver, President

The  
National  
Personnel  
System

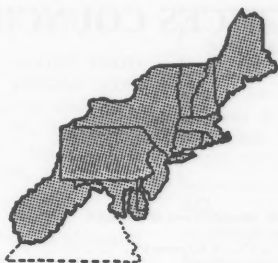
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## NORTHEAST DAIRY PRACTICES COUNCIL

### What Is This Council?

It is a nonprofit organization of education, industry, and regulatory personnel concerned with milk quality and sanitation in the dairy industry in the northeastern states. It was founded in 1970.

### OBJECTIVES

The objectives of the Council are to:

Develop and disseminate education guidelines for the dairy industry, especially as related to proper and improved sanitation and production of high quality dairy products.

Provide mutual assistance among the Northeastern States in adopting sound, uniform, improved procedures concerning the production, processing, and distribution of milk and dairy products, especially as related to sanitation and product quality.

The intent of these objectives is not to duplicate but to cooperate with any other organization which has similar education goals.

\*Associate Member

### Abstracts of Recent Guidelines Prepared by Task Committees of the Northeast Dairy Practices Council

**GUIDELINES FOR THE INSTALLATION OF MILKING SYSTEMS, Publication: NDPC 12; Single Copy: \$2.00.**

September 1986

**Abstract:** The purpose of this guideline is to provide information to the dairyman and installer concerning the application to install and guidelines for installing milking systems. It includes routine maintenance checklists and sample application forms. The recommendations are kept in line with those of 3A Accepted Practices for Design, Fabrication and Installation of Milking and Milk Handling Equipment and with the Milking Machine Manufacturers Council of the Farm and Industrial Equipment Institute.

**NORTHEAST EXTENSION PUBLICATION, CONFERENCES, SHORT COURSES, CORRESPONDENCE COURSES, AND VISUAL AIDS IN DAIRYING, Bulletin: NDPC 8; Single Copy: \$5.00.**

October 1986

**Abstract:** This Guideline lists the extension publications relating to the dairy industry available from the Land Grant universities of the twelve northeastern states. It gives the author(s), number of pages, date of publication (when available) and cost. It also lists conferences, short courses, correspondence courses and visual aids in dairying. It is updated annually and made available at the NDPC annual meeting during the first week of November.

**SELECTED PERSONNEL IN MILK SANITATION, Bulletin: NDPC 3; Single Copy: \$3.00.**

October 1986

**Abstract:** This guideline is a compilation of official regulatory personnel responsible for sanitation in the dairy industry in the thirteen northeastern states. This directory is updated annually and made available at the annual conference of the Northeast Dairy Practices Council.

Copies of Guidelines can be obtained at prices indicated from: Richard R. March, Executive Secretary, 150 Riley-Robb Hall, Cornell University, Ithaca, NY 14853-5701.

# GUIDELINES PREPARED BY THE NORTHEAST DAIRY PRACTICES COUNCIL

November 1986

## GUIDELINES PREPARED BY THE NORTHEAST DAIRY PRACTICES COUNCIL

Title	Guideline Number	Latest Edition	Price Per Copy	Title	Guideline Number	Latest Edition	Price Per Copy
Dairy Cow Free Stall Housing Systems . . . . .	NDPC 1	Jan.'80	\$ 2.99	Butterfat Determinations of Various Dairy Products . . . . .	NDPC 34	Oct.'79	2.00
Selected Personnel in Milk Sanitation . . . . .	NDPC 3	Oct.'85	3.99	Dairy Plant Waste Management . . . . .	NDPC 35	Oct.'80	4.00
Cleaning & Sanitizing of Milking Machines and Farm Milk Tanks . . . . .	NDPC 4	Aug.'82	2.00	Dairy Farm Inspection . . . . .	NDPC 36	Jul.'81	5.00
Cleaning Vacuum Lines - Supplement to NDPC-4 . . . . .	NDPC 4-51	Sep.'83	.50	Supplement to Guideline 36 . . . . .	36-51		.50
Sampling Fluid Milk . . . . .	NDPC 7	Jun.'80	2.99	" . . . . .	36-52		.50
Northeast Extension Publications, Conferences, Short Courses, Correspondence Courses, and Visual Aids in Dairying . . . . .	NDPC 8	Oct.'85	4.99	" . . . . .	36-53		.50
Fundamentals of Cleaning & Sanitizing Dairy Equipment . . . . .	NDPC 9	Sep.'83	2.99	" . . . . .	36-54		.50
Sentary Maintenance of Recirculated Cooling Water Systems - Supplement to NDPC-9 . . . . .	NDPC 9-51	Jul.'84	.50	" . . . . .	36-55		.50
Fluid Milk Shelf Life . . . . .	NDPC 10	Jul.'84	2.99	" . . . . .	36-56		.50
Sediment Testing & Producing Clean Milk . . . . .	NDPC 11	Oct.'85	2.99	" . . . . .	36-57		.50
Installation of Milking Systems . . . . .	NDPC 12	Feb.'81	2.99	Stall Barns . . . . .	NDPC 37	Oct.'81	2.00
Structural & Environmental Considerations for Milking Parlors . . . . .	NDPC 14	Jan.'75	2.00	Single Story Sloping Tie Stall Dairy Barn Plans . . . . .	NDPC-37-51	Apr.'86	.50
Handling Liquid Effluent from Milking Centers	NDPC 15	Jul.'75	3.99	Preventing Off Flavors in Milk . . . . .	NDPC 38	Oct.'85	3.00
Handling Dairy Products from Processing to Consumption . . . . .	NDPC 16	Jul.'84	2.99	Milk Plant Inspection . . . . .	NDPC 39	Oct.'82	5.00
Causes of Added Water in Milk . . . . .	NDPC 17	Oct.'85	2.99	Supplement to Guideline 39 . . . . .	39-51		.50
Abnormal Milk - Fieldman's Approach . . . . .	NDPC 18	Jun.'80	2.99	" . . . . .	39-52		.50
Dairy Farm Heat Exchangers for Heating Water . . . . .	NDPC 19.1	Jun.'79		" . . . . .	39-53		.50
In-Line Milk Cooling on the Farm . . . . .	NDPC 19.2	Jun.'79	2.00	" . . . . .	39-54		.50
Troubleshooting Refrigeration Systems . . . . .	NDPC 19.3	Jun.'79		" . . . . .	39-55		.50
Cleaners & Sanitizers for Dairy Farms . . . . .	NDPC 20	Mar.'86	3.00	Fluid Milk Volume and Fat Losses . . . . .	NDPC 40	Jun.'82	3.00
Raw Milk Quality Tests Including Flavor . . . . .	NDPC 21	Jul.'84	2.99	Milk Rooms and Bulk Tank Installations . . . . .	NDPC 41	May.'82	3.99
Control of Antibiotics & Growth Inhibitors in Milk and Milk Products . . . . .	NDPC 22	Jan.'85	2.99	Stray Voltage . . . . .	NDPC 42	Feb.'86	2.00
Preventing Rancid Flavors in Milk . . . . .	NDPC 23	Nov.'76	2.00	Farm Tank Calibration and Checking . . . . .	NDPC 43	May.'83	2.99
Troubleshooting High Bacteria Counts of Raw Milk	NDPC 24	Jan.'81	2.99	Troubleshooting Mechanical Ventilation Systems . . . . .	NDPC 44	May.'83	2.99
Cleaning and Sanitizing Bulk Pickup Tankers . . . . .	NDPC 25	Oct.'78	2.99	Gravity Flow Gutters for Manure Removal in Milking Barns . . . . .	NDPC 45	Sep.'83	2.00
Milking Parlor Types & Selection . . . . .	NDPC 26	Apr.'77	3.99	Dairy Odor Control . . . . .	NDPC 46	Feb.'84	2.00
Dairy Manure Management:				Naturally Ventilated Dairy Cattle Housing . . . . .	NDPC 47	Feb.'84	2.00
Planning . . . . .	NDPC 27.1	Jan.'77	3.00	Cooling of Milk on the Farm . . . . .	NDPC 48	Mar.'84	2.99
Land Application . . . . .	NDPC 27.2	Jun.'78		Postmilking Teat Opts . . . . .	NDPC 49	Mar.'85	2.00
Liquid Manure Storage . . . . .	NDPC 27.3	Jan.'77		Farm Bulk Milk Collection Procedures . . . . .	NDPC 50	Oct.'84	2.99
Semi-Solid Manure Storage . . . . .	NDPC 27.4	Jun.'78		Controlling the Accuracy of Electronic Testing Instruments for Milk Components . . . . .	NDPC 51	Oct.'84	2.00
Solid Manure Handling . . . . .	NDPC 27.5	Oct.'77		Emergency Action Plan for Outbreak of Milkborne Illness in the Northeast . . . . .	NDPC 52	Jul.'86	2.00
Handling Equipment . . . . .	NDPC 27.6	Oct.'77		Vitamin Fortification of Fluid Milk Products . . . . .	NDPC 53	Jul.'86	2.00
Spreading Equipment . . . . .	NDPC 27.7	Oct.'77		Note: Guidelines 2 & 5 are replaced by NDPC 27. Complete set in 3 volumes \$52.00			
Handling Milk Center Wastes . . . . .	NDPC 27.8	Oct.'77		Guidelines 6 & 13 are replaced by NDPC 41. Farm set in 2 volumes \$42.00 Plant set in 2 volumes \$38.00			
Runoff and Odor Control . . . . .	NDPC 27.9	Oct.'77					
Gravity Manure Handling . . . . .	NDPC 27.10	Nov.'84					
Troubleshooting Residual Films on Dairy Farm Milk Handling Equipment . . . . .	NDPC 28	Apr.'78	2.99	<u>Complete Set of Guidelines in 3 Volumes</u> . . . . .			
Cleaning and Sanitizing in Fluid Milk Processing Plants . . . . .	NDPC 29	Oct.'84	4.99	Volume 1 - Guidelines 1 thru 24	<u>Farm Quality Control in 2 Volumes</u>		
Potable Water on Dairy Farms . . . . .	NDPC 30	Mar.'86	3.99	Volume 2 - Guidelines 25 thru 37	Volume 1 - contains Guidelines 1, 3, 4, 7, 12, 14, 15, 17, 18, 19, 29, 21, 22, 23, 37, 40, 41, 42, 43, 44, 45, 46, 47, 48,		
Disinfection with Ultra Violet Light . . . . .	30-51	Oct.'86	.50	Volume 3 - Guidelines 38 thru 53	Volume 2 - contains Guidelines 38, 39, 40, 50, 51, 52, 53.		
Nutritive Value of Dairy Products . . . . .	NDPC 31	Mar.'79	2.00		Make checks payable to NDPC and send to R. P. March, 150 Riley-Robb Hall, Ithaca, NY 14853-5701		
Fat Test Variations in Raw Milk . . . . .	NDPC 32	Apr.'79	2.99				
Control and Eradication of Brucellosis . . . . .	NDPC 33	Oct.'79	3.00				



1987

**June 15-17, FLORIDA DAIRY PRODUCTS ASSOCIATION ANNUAL CONVENTION**, to be held at the Boca Raton Hotel & Club, Boca Raton, FL. For more information, contact: J. R. Antink, 14 E. Washington St., Suite 315, Orlando, FL 32801.

**June 15-18, BASIC FOOD PLANT MICROBIOLOGY**, to be held in Manhattan, Kansas. For more information, contact: Melinda Enns at 1-800-633-5137 or write: Registrar, American Institute of Baking, 1213 Bakers Way, Manhattan, Kansas 66502.

**June 17-19, ARKANSAS DAIRY PRODUCTS ASSOCIATION 52ND ANNUAL CONVENTION**, to be held at the Holiday Inn Lake Hamilton, Hot Springs, AR. For more information, contact: Floyd Smith, P.O. Box 4187, Asher Ave. Station, Little Rock, AR 72214.

**June 26-28, SOUTHEASTERN MEAT ASSOCIATION ANNUAL CONVENTION**, to be held at Ponte Vedra Inn & Club, Ponte Vedra Beach, FL. For more information, contact: Sara Jo Atwell, Southeastern Meat Association, 3437 SW 24th Avenue, Gainesville, FL 32607. 904-372-0436.

**July 6-10, CANADIAN INSTITUTE OF PUBLIC HEALTH INSPECTORS (CIPHI) 53RD ANNUAL EDUCATIONAL CONFERENCE**, to be held in Saint John, New Brunswick, Canada. For more information, contact: Mark Allen, Conference Chairman, Box 5001, Fredericton, N.B., Canada E3B 5H1. 506-453-2757.

**July 10-18, SEVENTH INTERNATIONAL WORKSHOP ON RAPID METHODS AND AUTOMATION IN MICROBIOLOGY**, to be held at Kansas State University, Manhattan, KS. For more information, contact: Dr. Daniel Y.C. Fung, Director of the workshop. 913-532-5654.

**July 14-16, BASIC PASTEURIZATION COURSE**, to be held in San Antonio, TX. Location to be announced. For more information, contact: Ms. Janie F. Park, TAMFES, P.O. Box 2363, Cedar Park, Texas 78613-2363. 512-458-7281.

**July 27-29, QUALITY CONTROL SEMINAR**, to be held at the Holiday Inn Holiday in Manhattan, KS. For more information, contact: The Registrar, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

**July 27-30, LIQUITEC EXPO '87 TECHNICAL WORKSHOPS AND EDUCATIONAL SEMINARS**, to be held at the Philadelphia Civic Center. For more information, contact: Liquitex Expo '87, Box 630, West Paterson, NJ 07424. 201-256-0011.

**August 2-4, WEST VIRGINIA DAIRY PRODUCTS ASSOCIATION ANNUAL MEETING (75TH ANNIVERSARY)**, to be held at the Greenbrier, White Sulphur Springs, WV. For more information, contact: Paul M. Smith, Room 1054 Ag. Sci. Bldg., Box 6108, Morgantown, WV 26506-6108.

**August 2-6, IAMFES 74TH ANNUAL MEETING**, to be held at the Disneyland Hotel, Anaheim, California. For more information, contact Kathy R. Hathaway, IAMFES, Inc., PO Box 701, Ames, IA 50010. 800-525-5223, in Iowa 515-232-6699.

**August 2-7, CALIFORNIA ASSOCIATION OF DAIRY AND MILK SANITARIANS BUSINESS MEETING**, to be held at the Disneyland Hotel in Anaheim, CA. For more information, contact: Richard Harrell at 213-757-9719 or Austin Olinger at 818-968-9621.

**August 5-7, IOWA DAIRY FOODS ASSOCIATION ANNUAL CONVENTION**, to be held at the Village West, Lake Okoboji, IA. For more information, contact: John R. Brockway, 1805 74th Street, Des Moines, IA 50322.

**August 9-14, ANNUAL MEETING OF THE SOCIETY FOR INDUSTRIAL MICROBIOLOGY**, to be held at The Hyatt Regency Hotel, Baltimore, Maryland. For more information, contact: Mrs. Ann Kulback, SIM, P.O. Box 12534, Arlington, VA 22209. 703-941-5373.

**August 16-18, WISCONSIN DAIRY PRODUCTS ASSOCIATION, INC. JOINT ANNUAL MEETING & CONVENTION WITH MIDWEST DAIRY PRODUCTS ASSOCIATION, INC.**, to be held at The Abbey on Lake Geneva, Fontana, WI. For more information, contact: Norm E. Kirschbaum, 1400 E. Washington Ave., Suite 185, Madison, WI 53703.

**August 16-18, MICHIGAN DAIRY FOODS ASSOCIATION ANNUAL CONVENTION**, to be held at Boyne Highlands Resort, Harbor Springs, MI. For more information, contact: Frank Koval, 748 N. Cedar St., Lansing, MI 48906.

**August 17-21, BIOTECHNOLOGY: MICROBIAL PRINCIPLES AND PROCESSES FOR FUELS, CHEMICAL AND BIOLOGICALS**, to be held at the Massachusetts Institute of Technology, Cambridge, MA. For more information, contact: Director of Summer Session, MIT, Room E19-356, Cambridge, MA 02139.

**August 31-September 4, 71ST ANNUAL SESSIONS OF THE INTERNATIONAL DAIRY FEDERATION**, to be held in Helsinki, Finland. For more information, contact: Harold Wainess, Secretary, U.S. National Committee of the IDF (USNAC), 464 Central Avenue, Northfield, IL 60093. 312-446-2402.

**September, WAMFES ANNUAL MEETING**, to be held in Eau Claire, WI. For more information, contact: Randy Dags. 608-266-9376.

**September 1-2, FOOD PROCESSING WASTE CONFERENCE**, Radisson Hotel, Atlanta, GA. For more information, contact: Edd Valentine or Chuck Ross, Georgia Tech Research Inst., Economic Development Labo-

ratory, Environmental, Health and Safety Division, O'Keefe Building, Atlanta, GA 30332. 404-894-3412.

**September 8-10, BASIC PASTEURIZATION COURSE**, to be held at the Viscourt Hotel in Houston, Texas, 713-526-4571. For more information, contact: Ms. Janie F. Park, TAMFES, P.O. Box 2363, Cedar Park, TX 78613-2363. 512-458-7281.

**September 9-10, NEBRASKA DAIRY INDUSTRIES ASSOCIATION ANNUAL CONVENTION**, to be held at the Best Western Regency West, Omaha, NE. For more information, contact: Michael Liewen, 134 Filley Hall, University of Nebraska, Lincoln, NE 68583-0919.

**September 9-10, UNITED DAIRY INDUSTRY ASSOCIATION ANNUAL MEETING**, to be held at the Marriott O'Hare, Chicago, IL. For more information, contact: Edward A. Peterson, 6300 N. River Road, Rosemont, IL 60018.

**September 10-13, DAIRY PRODUCTS INSTITUTE OF TEXAS FALL BOARD OUTING**, to be held at Horseshoe Bay Resort, TX. For more information, contact: Glenn R. Brown, 201 Vaughn Building, Austin, TX 78701.

**September 14-15, ASSOCIATED ILLINOIS MILK, FOOD, AND ENVIRONMENTAL SANITARIANS FALL SEMINAR AND ANNUAL MEETING**, a joint conference with the Chicago Dairy Technology Society. For more information, contact: Dr. Clem Honer, Secretary Associated Milk, Food and Environmental Sanitarians, Gorman Publishing Co., 8750 W. Bryn Mawr, Chicago, IL 60631. 312-693-3200.

**September 14-17, AOAC TO HOLD IOIST ANNUAL INTERNATIONAL MEETING**, to be held at The Cathedral Hill Hotel, in San Francisco. For more information, contact: the AAOAC office at 1111 N. 19th St., Suite 210, Arlington, VA 22209. 703-522-3032.

**September 14-18, FOOD MICROBIOLOGY SHORT COURSE**, sponsored by the University of California and University Extension. To be held at the Department of Food Science and Technology, Cruess Hall, UC Davis Campus. For further information, contact: Kathryn J. Boor, Food Science and Technology, University of California, Davis, CA 95616. 916-752-1478.

**September 15-16, 1987 ANNUAL CONVENTION OF THE SOUTH DAKOTA STATE DAIRY ASSOCIATION**, to be held at Howard Johnson's, Sioux Falls, SD. For more information, contact: Shirley W. Seas, South Dakota State Dairy Association, University Dairy Building, Brookings, SD 57007. 605-688-5420.

**September 17-18, WISCONSIN LABORATORY ASSOCIATION ANNUAL EDUCATION CONFERENCE**, to be held at the Holiday Inn, Fond du Lac, WI. For more information, contact: Sharon Klueder, 616 1/2 Garfield Ave., Wausau, WI 55401. 715-848-

1406.

**September 17-18, MINNESOTA SANITARIANS ASSOCIATION ANNUAL MEETING**, to be held at the Earle Brown Center, Univ. of Minnesota, St. Paul Campus. For more information, contact: Roy E. Ginn, Dairy Quality Control Inst., 2353 N. Rice St., Room 110, St. Paul, MN 55113. 612-484-7269.

**September 20-23, NATIONAL DAIRY COUNCIL OF CANADA 70TH ANNUAL CONVENTION**, to be held at the Quebec Hilton, Quebec, Canada. For more information, contact: Dale A. Tulloch, 141 Laurier Avenue West, Ottawa, Ontario, Canada K1P 5J3.

**September 21-23, NEW YORK STATE ASSOCIATION OF MILK & FOOD SANITARIANS ANNUAL MEETING**, to be held at the Sheraton Inn Syracuse, (Liverpool, NY). For more information, contact: Paul J. Dersam. 716-937-3432.

**September 24-25, SWEETENERS IN FOODS: SENSORY, PROCESSING AND HEALTH ASPECTS**, to be held at Kansas State Union, Kansas State University, Manhattan, KS. For more information, contact: Dr. Carol Setser or Dr. Karen Penner, Department of Foods and Nutrition, Justin Hall, Kansas State University, Manhattan, KS. 913-532-5508.

**September 28-29, SEMINAR ON "CONTEMPORARY QUALITY ASSURANCE,"** jointly sponsored by the International Dairy Federation and USNAC. To be held in McCormick Place, Chicago, IL. For more information, contact: Harold Wainess, Secretary, U.S. National Committee of the IDF (USNAC), 464 Central Avenue, Northfield, IL 60093. 312-446-2402.

**September 30-October 2, KANSAS ASSOCIATION OF SANITARIANS ANNUAL MEETING**, to be held at the Holidome in Lawrence, Kansas. For more information, contact: John M. Davis. 316-268-8351.

**October 5-9, 13TH INTERNATIONAL SYMPOSIUM OF THE IUMS-ICFMH & FECS-WPFC, "Toxins in Foodborne Disease" and "Microbiology of Drinking Water,"** to be held in Halkidiki, Greece. For more information, contact: Prof. J. A. Papadakis, Omirou 24, 10672 Athens, Greece.

**October 12-14, BIOTECHNOLOGY PROCESSING ENGINEERING CENTER THIRD ANNUAL SYMPOSIUM**, to be held at the Massachusetts Institute of Technology, Cambridge, MA 02139. For more information, contact: Diana Kenney, MIT, Room 20A-207, Cambridge, MA 02139. 617-253-0805.

**October 18-21, CORNELL SYMPOSIUM ON CHEESE BIOTECHNOLOGY AND INTERNATIONAL FOOD DEVELOPMENT**, to be held at Cornell University, Ithaca, NY. For more information, contact: Richard A. Ledford, Chairman, Department of Food Science, Cornell University, Ithaca, NY 14853-7201. 607-255-7616.

**October 19-21, DESCRIPTIVE ANALYSIS**, to be held in Palo Alto, California. Pre-registration required. For more information,

contact: Herbert Stone, President, Tragon Corporation, 365 Convention Way, Redwood City, CA 94063. 415-365-1833 or Telex WUI 6502215776 (access MCI).

**NOVEMBER, CANADA'S AMFES ANNUAL MEETING**, to be held in Edmonton, Alberta. For more information, contact: Jim Eisen. 451-0817.

**November 8-11, DAIRY INSTITUTE OF CALIFORNIA ANNUAL FALL MEETING**, to be held at The Lodge, Pebble Beach, CA. For more information, contact: Robert D. Boynton, Suite 718, 1127 - 11th Street, Sacramento, CA 95814.

**November 10-12, BASIC PASTEURIZATION COURSE**, to be held in Texarkana, Texas. Location to be announced. For more information, contact: Ms. Janie F. Park, TAMFES, P.O. Box 2363, Cedar Park, Texas 78613-2363. 512-458-7281.

**November 15-18, SOUTHERN ASSOCIATION OF DAIRY FOOD MFRS., INC. 73RD ANNUAL CONVENTION**, to be held at Colonial Williamsburg Foundation, Williamsburg, VA. For more information, contact: John E. Johnson, P.O. Box 10506, Raleigh, NC 27605

**November 30-December 3, NATIONAL MILK PRODUCERS FEDERATION ANNUAL MEETING**, to be held at the Hyatt Regency, New Orleans, LA. For more information, contact: James C. Barr, 1840 Wilson Blvd., Arlington, VA 22201.

**November 30-December 4, THE FIRST LATIN AMERICAN CONGRESS ON FOOD MICROBIOLOGY AND THE I ARGENTINE SYMPOSIUM ON PRESERVATION OF FOODS**, to be held in Buenos Aires, Argentina. For more information, contact: Dr. Ricardo Sobol, Secretary General, Bulnes 44 P.B. "B", 1176 Buenos Aires, Argentina. Additional information: Dr. Fernando Quevedo, 525 Twenty Third St., N.W., Washington, D.C. 20037.

**December 8-11, WORKSHOP IN INSTRUMENT SERVICE AND REPAIR**, to be held at the Anderson training facility and dairy processing plant in Fultonville, NY. For more information, contact: Michael D. Cunningham, Anderson Instrument Company, Inc., R.D. #1, Fultonville, NY 12072. Telephone: 518-922-5315.

## 1988

**January 20-23, FOURTH INDUSTRY-WIDE U.S. DAIRY FORUM**, sponsored by the Milk Industry Foundation and International Ice Cream Association. To be held at the Innisbrook in Tarpon Springs, FL. For more information, contact: Joe Dugan, 888 Sixteenth Street, N.W., Washington, DC 20006. 202-296-4250; TELEX 150185.

**October 9-13, AACC ANNUAL MEETING**, to be held at the Hotel InterContinental San Diego, in San Diego, California. For more information, contact: Raymond J. Tarleton, American Assoc. of Cereal Chemists,

3340 Pilot Knob Road, St. Paul, MN 55121. 612-454-7250.

**July 31-August 4, IAMFES 75th ANNUAL MEETING**, to be held at the Hyatt Regency Westshore, Tampa, FL. For more information contact Kathy R. Hathaway, IAMFES, Inc., P.O. Box 701, Ames, IA 50010. 800-525-5223, in Iowa 515-232-6699.



We're going to  
**ANAHEIM in 1987**

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for the **International Association of Milk, Food and  
Environmental Sanitarians, Inc. Annual Meeting**

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**August 2-6**

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A visit to Disneyland, the "Happiest Place on Earth", promises to be one of the entertainment highlights of our 1987 meeting. Special-value tickets available to IAMFES members at registration.

**Make plans now to join us in Anaheim in August**





One Cow, One Cow,  
that father bought  
for two zuzim,  
One Cow, One Cow,

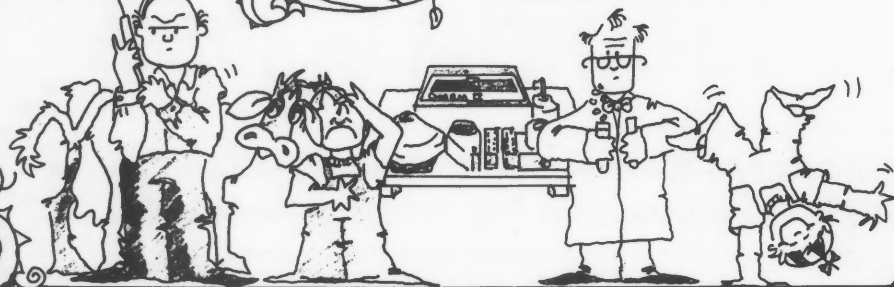
And the bug came  
and infected the cow  
that father bought  
for two zuzim.  
ONE COW, ONE COW.

And the tetracycline came  
and killed the bug  
that infected the cow  
that my father bought  
for two zuzim.

And the child came  
and drank the milk  
that contained the tet'  
that killed the bug  
that infected the cow  
that my father bought  
for two zuzim.

And the test was needed  
to save the child  
that drank the milk  
that contained the tet'  
that killed the bug  
that infected the cow  
that my father bought  
for two zuzim.

And Stanley came  
and invented the test  
that saved the child  
that drank the milk  
that contained the tet'  
that killed the bug  
that infected the cow  
that my father bought  
for two zuzim.  
ONE COW, ONE COW,



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